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WHOLE No. 3135

NEW YORK, SATURDAY, APRIL 6, 1918

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Supt.

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AMERICAN
GAS ENGINEERING JOURNAL

FORMERLY THE AMERICAN GAS LIGHT JOURNAL

Vol. CVIII, No. 14 NEW YORK, APRIL 6, 1918 Whole No. 3135

Gas for House Heating

Prominent Gas Men Express Their Views on the Subject—Importance of Going Slow in Building Up Seasonal Load Without Providing Other Loads to Keep Plant Busy During Off-Load Periods—Responsibility of the Gas Industry to Supply the Fuel the Public Demands

The developments of the past few winters—especially of the one we have just gone through—have compelled an altered viewpoint on the part of the gas industry towards house-heating business. As Jacob D. von Maur points out, "discussion as to what we will do" is more or less fruitless. It is a case of "what will we have to do" and how are we going to do it.

The attitude of the *"American Gas Engineering Journal"* in regard to house heating at the present time is well known to its readers. The following are opinions of gas men well qualified to speak authoritatively on the subject. Some agree with us. Others disagree. The columns of the *"Journal"* are open to widespread discussion on the subject. The viewpoints of all who have studied the subject and have formed definite opinions in regard to it are very much desired.

There is a Demand for Our Product—It is for Us to Find a Means of Meeting that Demand—Jacob D. von Maur

SIR: Referring to your letter of Feb. 23, in which you quote from page 153 of the AMERICAN GAS ENGINEERING JOURNAL of Feb. 16, and ask my opinion as to the correctness of your position on the subject of the house-heating branch of the gas business, would say that the principles governing the successful operation of the gas business are no different than the principles which govern any other successful manufacturing industry.

To get the best results all parts of the plant must be used to their fullest extent, and where any particular apparatus can be put to several uses, this should be done.

At the present time the artificial gas manufacturing plants are used to far greater extent during some periods of the year than they are at other periods, and common sense would dictate that the main effort should be applied to increasing the use of the plant during the periods of the year when the present demands are far short of the capacity of the plant. In other words, fill up the valleys in the load curve.

The objection to the house-heating business has always been stated as being due to the fact that it creates a demand for increased production at the plant at the very time when the plant is already operating under its peak load, so that in order to take care of the additional business additional plant capacity is required. While the profit from this additional business was not considered as being sufficient to warrant the investment necessary to provide the increased plant capacity, it was at the same time generally considered by the large majority of gas men to be good business to sell small auxiliary appliances for house heating, such as gas grates, room heaters, etc.

The pushing of complete installations for house-heating purposes was considered a mistake, and if special rates for gas used for such purposes were adopted as a permanent policy by the gas company, it certainly would be a mistake.

During the past season we have seen the condition where a prolonged spell of cold weather, coupled with the shortage of coal, resulted in an abnormal demand for gas, which was undoubtedly caused by consumers using all available means at their command, including gas grates, room heaters and other appliances for the purpose of heating their houses. Thus we see that the same results which were predicted, and argued against the policy of taking on the business of independent house heating, resulted from the simultaneous use of the small space or room heaters. Gas companies that never countenanced the sale of gas for independent house-heating plants found themselves unable to supply the demand caused by the condition which confronted them during the past winter season. Even if gas companies had not encouraged the sale of these small auxiliary heating appliances the same condition would

have produced the same results, although in a modified form, for gas ranges and open gas jets would have been utilized as room-heating appliances.

The question is not, therefore, *what will we do, but, rather, what will we have to do? A public demand must be satisfied.* Gas must be sold for all purposes for which it is applicable, and surely no gas man will say that gas is not applicable for such uses as it was put to during the past winter.

There have been some who have said that "gas is a back number—it is out of date." I venture to say that such men have now been silenced, and all are at this date willing or else forced to admit that artificial gas is very much up to date, and was found not only convenient, but decidedly essential during the past winter. *Will we now grasp our new opportunities and "strike while the iron is hot"? Will we grapple with the new problem presented and rise to the occasion and solve the difficulties, or will we bemoan the fact that when people are cold they burn gas to keep warm, and complain that people demand our product in larger quantities than we are prepared to sell?*

Imagine the management of a department store protesting because everybody wants to buy something around Christmas instead of distributing their purchases between Dec. 25 and Aug. 5.

There is a demand for our product. It is for us to find a way of meeting that demand. No concern can sell its product for less than it costs and live. A gas company certainly cannot take on all kinds of business unless it does so at rates and under conditions that will leave a net profit on the entire transaction. The consumers cannot expect to be served, nor is it possible to serve them at a price less than the fair cost of the service. When there is a great demand for the use of money, the cost to serve, that is the rate of interest, goes up. The demand creates a shortage of money to loan, and soon the rate reaches a point where he who wishes to borrow decides to postpone borrowing, suffers rather than pay, or finds some other means of getting over his difficulties. The whole contention is met by first utilizing all resources available and by the flexibility of the rate.

Perhaps a way may be found whereby the price of gas will be a function of the demand made on the plant by each consumer. A number of our most recent rates do this to a certain extent.

The group system of meters is a step in advance, but it will be noted that the abnormal amounts of gas which were supplied during the last season were sold through the same distribution system, the same service and the same meter as were in place before. No new equipment was supplied, and practically no new investment was made to supply the demand.

The five-light meter simply worked longer hours, and gas passed through the service pipes, mains, etc., in a more continuous fashion. The five-light meter instead of drawing on the works for, say, 100 ft. per day, called for two, three or four times that amount, but the rate when made did not take this condition into consideration.

If the public demands that we provide capacity to take care of these unusual conditions, the plants must be provided and the investment must be made a factor in fixing the rate.

After all, it is wonderful what we can do when we have to do it. Actual shortage of fuel, of course, is something that no amount of ingenuity can remedy, but even with all of our difficulties that confronted us during the recent cold spell of weather the facts remain that we did pull through—more gas was sold than many thought it possible to supply. I am confident that a way will be found by which we will be able to meet all difficulties. *We must not say "we won't," and we will not say "we can't," but the best attitude is to say and feel that we must.*

JACOB D. VON MAUR,
Superintendent of Distribution, Laclede Gas Light Company, St. Louis, Mo.

Not a Profitable Business Unless Higher Rate than for Other Business is Charged —Alfred E. Forstall

SIR: The successful pushing of gas for house heating may be a national duty, but it will not be a profitable business for gas companies which have to manufacture the gas that they sell, unless a price is charged for gas used for this purpose which is much higher than the price charged for gas used for ordinary domestic purposes.

ALFRED E. FORSTALL,
President American Gas Institute.

Liberal and Broad Gauged Treatment from Regulatory Bodies Needed—Charles M. Cohn

SIR: Replying to your favor of the 23rd instant, the problem of gas for house heating is a complicated and difficult one. It involves not only a careful study of the rate problem, the proper methods of charging for gas, but also the securing of other business which would offset the seasonal load factor of the house-heating business. This requires a careful survey and study of the whole situation from a commercial standpoint. Whether this is a propitious time to inaugurate a movement such as you suggest—pushing gas for house heating—is open to some serious question, as most gas companies are now confronted with most unusual operating conditions, and it is extremely difficult to forecast the extent to which gas companies will be obliged to assume additional operating burdens. Then, again, the securing of new capital with which to purchase equipment to meet the rapidly increasing demands for gas is assuming serious proportions. These conditions are not calculated to encourage the entering of comparatively new and untried fields of exploitation. What the gas industry needs to-day is liberal and broad-gauged treatment from the regulatory bodies of the country, and this can be done without sacrificing the public interests, as the economic conditions themselves impose sufficient restrictive and controlling features.

CHARLES M. COHN,
Vice-president, Consolidated Gas, Electric Light & Power Company of Baltimore, Baltimore, Md.

EDITOR'S NOTE: *Mr. Cohn's letter was written before the attitude of the President and the Secretary of the Treasury was made public. The* AMERICAN GAS ENGINEERING JOURNAL *wrote him a second time, inquiring if this expression on the part of the National Govern-*

ment did not at least in part furnish the answer to the difficulties that, in his opinion, stand in the way. The following is Mr. Cohn's answer:

SIR: The attitude of the Federal Government is undoubtedly a factor which should be considered in any study of the gas house-heating problem, but it is by no means the controlling factor, and likewise the prospects of financial assistance through the pending war finance bill offers some temporary relief. The whole situation, however, is one that has many elements of uncertainty, as we cannot forecast the future now with anything like the same confidence that we could under normal conditions; for instance, the matter of obtaining raw materials—coal and oil—is becoming more and more difficult, and the constantly increasing costs of these materials are adding increasing burdens. I do not mean to discourage your suggestion, but cannot fail to advise caution.

CHARLES M. COHN.

E. C. Jones Agrees that Gas for House Heating is a National Duty

SIR: I am very much interested in your letter in regard to the use of gas for heating as a national duty, and I am sure that you are right in the position you have taken on the house-heating branch.

My long devotion to the gas business may possibly prejudice me in its favor, but the longer I stay in the business the more I realize the boundless possibilities of gas, and I deplore the seeming lack of faith and enthusiasm.

The text books of our business speak of gas as a product of the "Destructive Distillation of Coal," but I have always looked upon the use of coal for gas making as a *constructive* measure. The unlocking of a pound of coal liberates an endless number of analytic and synthetic products which make life better worth living. It produces a gaseous fuel which is convenient, cleanly and economical, and although this fuel contains but a relatively small portion of the theoretical number of heat units in the coal, these heat units may be so readily applied in heating, cooking or lighting that the householder or industrial user of gas saves money by its use.

As I was walking down the street in San Francisco the other day I noticed a display ad worded as follows:

"GAS A PRODUCT OF CALIFORNIA OIL

"Gas manufacture and delivery takes few men, no ships, no railroad cars—freeing them for war usage.

"Gas usage is a war economy—a comfort in time of peace.

"USE GAS,"

and the truth of the statement impressed me.

I believe that the intelligent use of gas during wartime is a measure of conservation of labor and material.

Coal is brought to the docks of the gas company in the East, and with a minimum of labor is converted into an ideal fuel, which is distributed through pipes to the consumer; but if this same amount of coal is to be used for domestic purposes it must be screened, weighed, delivered and placed in the stoves or furnaces, and the ashes removed and conveyed to a dumping place. Each of these steps involves time and manual labor, and if the ordinary gas appliances now in use were much less efficient in developing the heating value of the gas, I believe that the occasional use of these appliances, as compared with the uninterrupted use of solid fuel, would still leave gas the cheaper means of getting heat.

In time of war the use of gas is a patriotic duty for another reason. Toluol, which is so much needed at this time, is a constituent of illuminating gas, and is recovered at the gas works before the gas is sent to the consumer without injuring the value of the gas to the consumer. The more gas used the more toluol produced, and the more toluol produced the quicker this war will end.

I must take exception to the last paragraph in your letter, which says:

"The quality of the JOURNAL is not necessarily a vital matter to you personally. You have arrived at a place where you are 'sufficient unto yourself.'"

The welfare of our industry depends much upon the quality of your JOURNAL, and that is very vital to me. I cannot imagine where you get the idea that a gas man can be "sufficient unto himself." The longer I stay in the business the more I am impressed with the interdependence of human beings, and this becomes more apparent as a man gets out into the field and tries to do things. Long years of experience in the gas business have brought me to a point where I am not so sure of so many things that are not so, but I am glad to have collected a few axioms of the gas business which have proven unassailable. The gas associations have done much to bring the thought of the gas men into closer relation, but to place our business where it belongs will require an unselfish co-ordination of effort on the part of every live gas man in the country.

I think you know that I use my ranch as a training camp to fit me for clearer thinking, and I am often amused when I hear farmers talking about their independence. It is true that we produce nearly everything that is used for food, and probably the farmer is as nearly independent as an individual can be, yet when I look about the farm the idea of independence is grotesque, and the co-ordination of human efforts is in evidence on the farm as it is in the gas works, and without this the farmer would soon become a cave man digging potatoes with his hands. Surely none of us is independent, and with a full realization of interdependence, with a spirit of helpfulness, the war should help the gas business, and the gas business should help to end the war.

E. C. JONES,
Chief Engineer, Gas Department, Pacific Gas & Electric Company, San Francisco, Cal.

E. N. Wrightington Leans to Gas for Auxiliary and Intermittent Heating

SIR: I have your letter of Feb. 23, and if you want a frank answer, I will say that I am not at all enthusiastic about the use of gas for heating houses exclusively throughout the winter in the climate and under the conditions that prevail in Boston.

In the first place, I believe that the cost will be far greater than with coal, and in the second place I believe that this class of business would be undesirable from the point of view of the gas company. I think that this last winter has clearly demonstrated the latter

fact. If we had had a general use of gas for house-heating purposes there would have been such a heavy demand upon the system that a very large capacity of distribution and manufacturing systems would have been required to handle it. This demand would have lasted for only a few days in the extreme coldest days of winter, and the investment, therefore, would have remained idle for all the rest of the year, including the summer months.

I believe that there is a very good field for auxiliary heating, and also for intermittent heating in the spring and fall of the year, but for continual use throughout the winter, I am of the opinion that gas is not desirable either for the customer or for the company.

E. N. Wrightington,
Vice-president, Boston Consolidated Gas Company,
Boston Mass.

Each Condition in Furnace Operation Must be Served by a Brick Made to Best Serve the Purpose the Furnace is Intended to be Used For

O. L. Kowalke Discusses Some Characteristics of Fire Clay and Silica Refractories—Composition of Bricks and Points to be Considered in Selecting Them

The answer to the question, "What is the best refractory?" is not simple. The use for which a refractory is intended will determine its composition and characteristics, declared O. L. Kowalke, of the Chemical Engineering Laboratories of the University of Wisconsin, in a paper presented at the recent annual meeting of the Wisconsin Gas Association. Because of the wide variation in quality of the raw materials and the indeterminate reactions in the process of burning the ware, the finished products will vary between wide limits. Some of these products will have the property of being infusible at the highest temperatures attained in combustion operations and of being resistant to cracking through sudden changes in temperatures. Some will resist the corrosive action of slags and fluxes and the cutting action of flames; others will resist abrasive actions. The principal refractory materials of importance to the gas industries are fireclay and silica; they have quite different properties and cannot be used interchangeably for all purposes.

Making the Bricks

Firebricks are made by moulding into the desired shapes a mixture of moist fireclay and grog, which after being dried is fired to about 1,300 deg. C. Fireclay is a most complex material, the principal ingredient being a hydrous silicate of alumina (Al_2O_3, 2 SiO_2, 2 H_2O), and in addition there may be many other elements present. The elements in clay other than the silicate of alumina have a decided influence on the way the clay behaves when heated. Clay does not possess a sharp melting point like copper or iron; it sinters together, becomes less porous, contracts in volume, and softens gradually until finally it will flow. The sintering of clay is accompanied by contraction, and is due to the melting of some of the more fusible constituents, which dissolve the less fusible and bind the whole into a compact mass. This contraction is increased by raising the temperature or extending the time of exposure. To avoid subsequent shrinkage, it is important that the brick be fired at a temperature higher than that obtained in the furnace where it is used.

What Constitutes the Grog

The greatest portion of the material used in brick is grog. Grog is a term applied to burnt fireclay or ground firebrick which serves as the framework. Mellor has called grog the skeleton and the clay bond the flesh of the refractory. When a brick is burned the clay bond sinters and part of its own more fusible constituents dissolve portions of the clay and of the grog. This plastic mass binds the skeleton together into a solid brick. Each clay has its own capacity for dissolving grog, and upon this fact depends to some extent the refractoriness of a brick. If grog is made of the same material as the bond clay the tendency toward mutual solution is increased. The character of the grog controls the contraction of the brick during burning because of its solubility in the bond clay. Some grogs are sparingly soluble in the clay, and the refractoriness of that brick is apt to be high.

The grog should be so graded as to size that the voids between the larger particles are filled with smaller particles and the whole cemented together by the clay. If only coarse particles of uniform size are used, shrinkage cracks in clay develop on drying and firing, which are sources of weakness. Coarse ground grog produces brick which are more resistant to cracking due to sudden changes in temperature than fine grained brick. Brick made with a coarse grog have a lower crushing strength cold, they do not resist wear and abrasion so well; they will in general resist a high temperature before softening; they do not resist corrosive slags and the cutting action of flames so well as brick made with a fine grog. Thus it is apparent that all conditions in furnace operations are not met by any one firebrick. Each condition must be served by a brick made with a combination of clay and grog that is best suited for the purpose.

Significance of Textures

Fine-grained texture gives brick the property of resisting the corrosive action of slags, dust, fluxes, etc. The slag or flux first attacks the bond clay and very soon eats out a small pocket. Should the grain be coarse, the particle of grog may fall or be scraped out and thus new surfaces of clay be exposed; with fine-grain texture there is not the danger of dislodgment of particles, but the slag or flux must eat its way in. For retorts and similar devices a fine texture material is superior to a coarse one, other things being equal, because of the lower porosity of fine-textured material there will evidently be less gas loss. On the other hand, a fine-textured refractory will crack easier with sudden changes of temperature. Hence for retorts the size of grog and its proportion to clay bond must be carefully determined. The preceding discussion has touched on only a few of the complex problems in fireclay ware. The problem with silica is somewhat simpler.

(*Continued on page* 339)

Industrial Lighting a Field of Wide Opportunity that Presents No Obstacle that Energy and Intelligence Cannot Surmount

But, Contends Robert ffrench Pierce, Unless the Gas Companies Are Prepared to Encourage Men to Become Really Proficient in the Practice of Illumination They Had Best Leave the Field Alone for Their Efforts Will Prove Unsuccessful

The commercial point of view with reference to any business seeks the answers to two questions: Is it worth while? and, How may it be obtained? according to Robert ffrench Pierce in his paper on "Factory Lighting," presented at the recent annual convention of the Wisconsin Gas Association. Factory lighting, and indeed all lighting, occupies a rather peculiar economic position in that it does not of itself offer the possibilities for profits of a magnitude comparable with some of the other classes of business which go to make up the revenues of the gas works or the central station.

In the aggregate, the revenues derived from lighting business are enormous, but with a given consumer the amount of energy required for producing light is usually but a fraction of the energy consumed for all purposes. The householder who uses, say, 6,000,000 B.t.u. per year to produce light, will use perhaps 250,000,000 B.t.u. per year for house heating, and the relative use of energy for light and power by the average industrial plants is of a somewhat similar order. Thus it is that when the seller of "manufactured energy" considers the relative magnitudes of the possibilities which lie before him, lighting fills but a small part of his field of vision.

Lighting Business of Factories Relatively Easy to Obtain

On the other hand, the lighting business of industrial plants is relatively easy to obtain. It involves a comparatively small investment on the part of the consumer, and lighting appliances are so well standardized that their satisfactory performance is not a matter of hope or conjecture but may be taken for granted. In the factory the principal consideration is economy of time, energy and money, and those refinements of adaptation and control, the lack of which has initiated against the use of gas light for many purposes, are of little or no importance, and, generally speaking, wherever gas lighting has any economic right to exist there are no countervailing reasons or other considerations which should prevent its adoption.

The effect of factory lighting business upon operating conditions at the generating plant is highly favorable. The load factor is satisfactory, running as high as 30 per cent, and the bulk of the load is "off peak." In this respect factory lighting is infinitely more desirable than residence lighting business.

One of the greatest, if not, indeed, the greatest, values of lighting business of all sorts to the "energy manufacturer" is its publicity value. This has been realized in the electrical industry to a much greater extent than in the gas industry.

Electric Lighting Brings Back Little Profit

In fact, it is hardly too much to say that the first classes of lighting business taken on by the electric central stations, residence lighting and street lighting, have been of recent years operated principally as advertising projects. At the present rates for energy for residence lighting, this sort of business directly produces little if any profit, and street lighting contracts are often deliberately taken on at figures representing the thinnest of margins above cost of production. Indeed, in cases of keen competition the electric central station is sometimes willing to forget costs entirely.

This is simply good, far-sighted business. If a certain class of lighting occupies such a position in the public eye as to increase the prestige of the illuminant furnishing it, it is just as sensible for a central station company to take the contract at a loss of $10,000 a year as it is to spend $10,000 a year in newspaper advertising, provided the two means of publicity are estimated to be of equal value and effectiveness.

There is hardly a highly successful merchandising concern in the United States which does not sell some portion of its goods at a relatively small profit, or even at a loss, as an advertising measure pure and simple, and the more successful merchant, with all his appreciation of the printed page, evidently believes that an ounce of demonstration is worth a pound of talk.

Lighting Produces Other Business

I am not by any means advocating the relinquishment of possible profits, or the conversion of the public utility into a philanthropic organization for the distribution of the stockholders' wealth. Wherever lighting business may be obtained at a large profit, by all means let it be done. The point I wish to make is simply this: Lighting business so inevitably produces and conserves other business, and so effectively advertises the form of energy which generates it, that it is entitled to special consideration as an advertising medium. What electric residence lighting is to the electric flatiron, chafing dish, vacuum cleaner and sewing machine motor, gas factory lighting is, or at any rate may be, to industrial fuel gas, and I submit that a campaign for factory lighting ought to constitute the first step in a campaign for industrial fuel, and should be regarded less as a

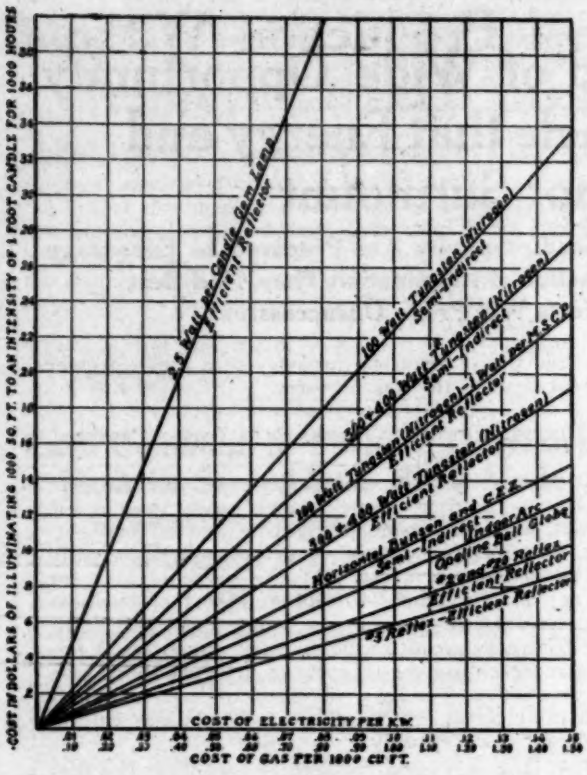
COST IN DOLLARS OF ILLUMINATING 1000 SQ. FT. TO AN INTENSITY OF 1 FOOT CANDLE FOR 1000 HOURS
2.5 Watt per Candle Gem Lamp
Efficient Reflector
100 Watt Tungsten (Kiltragan)
Semi-Indirect
1 Watt per M.S.C.P.
300 & 400 Watt Tungsten (Kiltragan)
Semi-Indirect
Efficient Reflector
100 Watt Tungsten (Kiltragan)
Efficient Reflector
300 & 400 Watt Tungsten (Kiltragan)
Efficient Reflector
Horizontal Bunsen and C.F.E.
Semi-Indirect
Enclosed Arc
Opaline Ball Globe
#2 and #3 Reflex
Efficient Reflector
#3 Reflex—Efficient Reflector
COST OF ELECTRICITY PER KW.
.10 .11 .12 .13 .14 .15 .16 .17 .18 .19 .20 .22 .24 .26 .28 .30
COST OF GAS PER 1000 CU. FT.

FIG. 1—THE RELATIVE ENERGY COST OF GAS AND ELECTRICITY FOR LIGHTING

direct revenue producer than an advertising campaign. Lighting has been the vantage point from which every great expansion of central energy supply has been launched. The all-gas kitchen has developed from the toe-hold given to gas in the home by gas lighting. The all-electric household required the electric lamp to pave the way. It can hardly be doubted that the prestige of electricity in store and public-building lighting would not exist to-day were it not for the painfully won and jealously guarded position of electricity in the street-lighting field.

Gas Lighting Suffers from Artificial Handicaps

From the economic point of view it must be granted at the outset that gas lighting suffers under certain artificial but none the less serious handicaps. Fig. 1 shows the relative energy cost of gas and electric light at various rates for energy. As long as "dollar gas" is compared with "ten-cent electricity" (or in this ratio) the former may be shown to possess an economic advantage of sufficient magnitude to insure its favorable consideration for industrial illumination.

Unfortunately, however, our electrical competitors have not chosen to ascribe supernatural origin or divine authority to a rate of 10 cents per kilowatt-hour, or to any other fixed and invariable rate, but commit the astounding heresy of basing the rate for each class of service partly upon the cost of rendering the service and partly upon what must be offered to get the business—not charging what the traffic will not stand.

The result is that the industrial plant purchases electricity at from 1 cent to 4 cents per kilowatt-hour, which puts an entirely different complexion upon the matter. Even 50-cent gas can do no more (on a purely economic basis) than barely compete with 2-cent electricity for lighting, considering energy costs only, and the gas lamp is a vastly more expensive apparatus than the electric lamp.

It occasionally happens that a particularly alert salesman, taking advantage of peculiarly favorable conditions, succeeds in selling gas lighting in the face of really cheaper competing electric light. Such salesmanship is commendable, but that is no reason why the entire industry should be burdened with an obsolete, illogical and discriminatory rate-making system which narrows its field, stifles initiative and strangles growth.

It is, I believe, quite commonly held in the gas business that scientific rate making is "impractical." If so, our electrical friends appear to have hobbled along quite successfully under an impractical system.

Introducing Impracticality in the Gas Business

If the rate-making system which has built the electrical industry is impractical, the more impracticality we can introduce into the gas business the better. No doubt we should, under our present handicap, do our best to obtain such business as may be had in spite of this disadvantage, but it is much more important that we bend every energy toward the removal of the drag of the present system of rates. Some blind men have accomplished wonderful things, but that is no reason why the blind should be content with their condition and make no effort to secure the restoration of sight.

The Legal Aspect of Industrial Lighting

Another aspect of industrial lighting which has recently required attention is the legal aspect. Under the initiative of the committee on lighting legislation of the Illuminating Engineering Society many States have made mandatory the maintenance of certain lighting conditions in industrial plants. In most cases these regulations embody or conform to the factory lighting code of the Illuminating Engineering Society.

These regulations are not statutory or legislative enactments, but executive rulings of the administrative branch of the Government—usually through the departments of labor of the States. The regulation of lighting conditions is, in this connection, simply the employment of the police powers of the State, quite similar to sanitary regulations in the interest of public health and having the same warrant of justice.

The fundamental purpose of these regulations is to conserve the health of the workman. It is not within the province of the labor department to impose regulations intended primarily to increase plant efficiency. If a manufacturer wishes to operate his plant inefficiently, that is his own affair (as far as present laws are concerned), but he must maintain conditions favorable to the health of his employees at their tasks.

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Hope is to Double Toluol Production Without Materially Inconveniencing Gas Consumers

F. E. Dodge Outlines History of Benzols Recovery and Describes Methods at Present Employed—Removing Water that Separates from Wash Oil at Scrubbers in Recovery from Water Gas

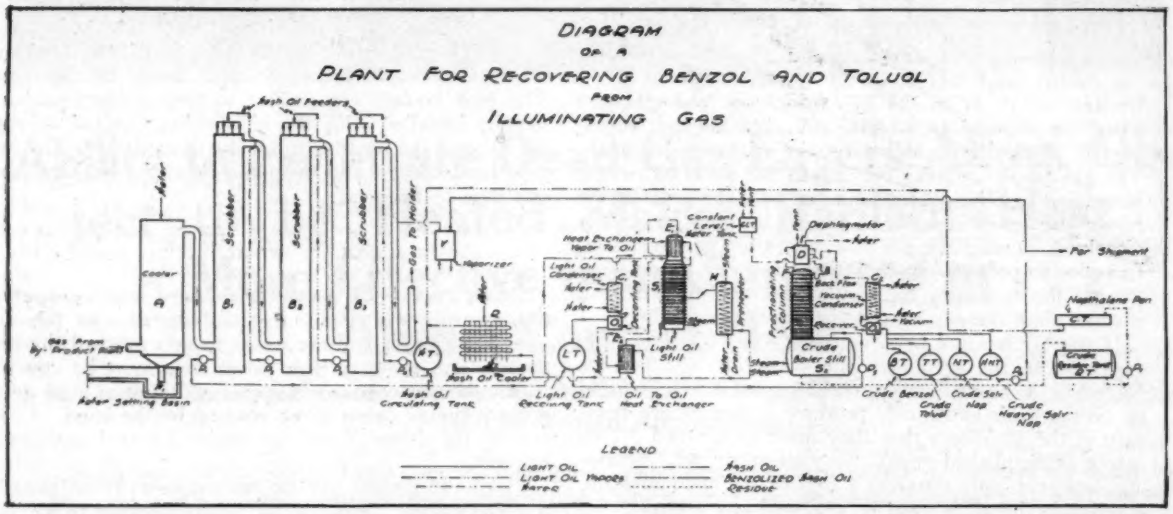
The benzols were first accurately determined to exist in the light distillate from coal tar by A. W. Hofmann in 1845, and he pointed out that the methods employed for the rectification of alcohol could be successfully employed for their separation, declared F. E. Dodge, in a paper presented at the annual convention of the Wisconsin Gas Association, held in Milwaukee, March 26 and 27. From this date to 1887, when F. Brunck applied the process proposed by Carves and worked out the details of a commercial plant, practically all of these compounds were obtained from oils like Pintsch hydrocarbon, holder oil, gas drips and water gas tar. Nearly as early as Hofmann's work, experiments conducted by the Paris Gas Company showed that the benzols were nearly all contained in the gas. Berthelot in 1876, Bunsen in 1877, Knublauch in 1880, Dennstedt and Ahrens in 1894 and Bunte in the same year confirmed this.

Various methods, such as compression and cooling to a low temperature, were proposed to separate these compounds from the gas.

In 1859 Vogel passed coal gas through colza oil, which he says took up 20.5 per cent of its weight of light oil and increased very much in illuminating power without materially affecting the quality of the gas. This last is, of course, absurd, as the removal of these compounds reduces the B.t.u. 5 to 6 per cent and the candle-power fully as much or more. Vogel did not aim to remove the benzols, but to improve the quality of colza oil for illuminating purposes.

Caro, Clemm and Engelhorn in 1869 used practically the same process that is now used, but the fall in the price of benzol and toluol and the low value of the stripped gas soon made it unprofitable.

The advent of by-product coke ovens led Franz Brunck at Kaiserstuhl to employ Carves' apparatus. This consisted of cylinders filled with pebbles or ganister, up which the gas passed and down which oil was allowed to trickle, after which the gas passed through several wash boxes, the lower part charged with oil, the gas entering from above and bubbling through the oil from a number of small tubes which dipped in the oil. These boxes were arranged so that the oil flowed from one to another by gravity and was pumped from the last wash box over the scrubbers so that the richest gas came in contact with the most concentrated benzol solution. They used heavy oil from the distillation of coal tar, as is now the usual practice in England and Europe. The light oil was separated in boiler stills (heated either by steam coils or external fires) and the heavy oil after cooling was returned to the wash boxes. A continuous still was substituted to debenzolize the wash oil in about 1894. Until 1900, when the Semet-Solvay Company began to recover light oil, all the benzol made in this country came from oil gas sources.



Amount Produced from Coke Ovens Only One-half of Total Amount

The amount of these compounds produced from coke-oven gas was only about one-half of the total production, until the high prices, which prevailed just after the beginning of the European war, stimulated by-product coke oven operators to put in plants to recover them from the gas.

Several plants in the United States operating water gas machines have put in apparatus to strip the aromatic compounds from the gas. The light oil thus obtained is

fractioned in a crude still and the stripped gas enriched by returning to it all but the toluol fraction. This, of course, lowers the candle-power or B.t.u. of the re-enriched gas only about one-sixth as much as if all aromatics were removed.

The illustration shows the general arrangement of the apparatus for the recovery of benzol from gas and the flow of the materials through it.

The apparatus consists of a gas cooler A, scrubbers B^1, B^2, B^3, vapor to oil heat exchanger E^1, oil to oil heat exchanger E^2, preheater H, continuous light oil still S^1, wash oil cooler R, wash oil circulating tank WT, light oil condenser C^1, light oil decanter O^1, light oil storage LT, crude boiler still S^2, column F, dephlegmator D, constant level water tank CLT, condenser C^2, receiver O^2, storage tanks BT, TT, NT, HNT, residue tank RT, naphthalene pan CT, and vaporizer V. The oils are circulated and transferred by pumps P^1, P^2, P^3, P^4, P^5, P^6 and P^7.

Operation

The operation of the apparatus consists of leading the cooled gas either from the cooler, as shown in the illustration, or from the gas works condensing house after the removal of tar and ammonia through scrubbers B^1, B^2 and B^3, which are filled with wooden grids. The gas passes counter current to the wash oil, which is sprayed or otherwise distributed over the grids at the top of the scrubbers, the oil having the most aromatics dissolved, meeting the gas as it enters the first scrubber. In order to prevent condensation of water vapor from the gas the scrubbing oil should be 1 deg. to 2 deg. C. warmer than the gas it meets in any other scrubber.

If the tar has not been entirely removed before the gas goes to the scrubbers the wash oil will become fouled by it, and a hard pitch-like substance will build up on the grids and finally produce so much back pressure in the scrubbers that they must be cleaned. This can be accomplished primarily by steaming out. Steaming, however, only removes a part of the accumulation, and finally the grids must be removed and scraped.

The wash oil, after having been circulated over all the scrubbers of the series, becomes partially saturated with aromatics.

The usual absorption is from 2 to 3 per cent. This oil is called benzolized oil. It is pumped through the vapor to oil heat exchanger, then to preheater, and then enters the continuous still at a temperature of from 120 to 150 deg. C.

Heat Exchangers

These heat exchangers are constructed entirely of iron or steel, and usually consist of tubular boxes similar to the tubular type of feed-water heaters.

The continuous still consists of a base section equipped with a steam spray pipe and a sealed outlet. Superimposed on this base are sections similar to the sections of the column of a rectifying still.

The hot oil enters the still about half way up the columns and descends, meeting a current steam which drives out the aromatic bodies, which pass toward the top, leaving part of the entrained wash oil on each plate, the light oil vapor finally leaving at the top at between 100 deg. to 105 deg. C. The vapors then enter the vapor to oil heat exchanger, which is a tubular surface condenser, with the vapors from the still and the benzolized wash oil to the still passing counter current. The vapors and condensate from this heat exchanger pass to a final condenser or cooler, which is best made in the form of a worm. If properly designed, a worm will deliver the distillate within 2 deg. or 3 deg. C. of the temperature of the cooling water supplied.

Of course, both the light oil and the steam supplied to the base of the still are condensed and cooled in the worm; the water and light oil separate by gravity in the decanter and flow to the sewer and light oil storage respectively.

The debenzolized wash oil leaves the base of the still at 110 deg. to 140 deg. C., passes through the oil to oil heat exchanger counter current to the benzolized wash oil, which has been through the vapor to oil heat exchanger. The debenzolized wash oil next passes to wash oil coolers, where the wash oil is finally cooled to the temperature used over the scrubbers. There are two types of these coolers, direct where the oil passes directly through water, and indirect, of which there are two forms, known as box and pipe coolers. The box coolers consist of boxes with tubes through which the oil should flow and around which the water should be circulated. The pipe coolers are similar to beer coolers, and are usually installed with the oil flowing upward through the pipes, the water being distributed over the top pipe by a trough and dropping down by gravity from one pipe to the next.

Conserving Water

Better cooling of the oil is obtained and a conservation of water when the oil is distributed over the outside of the pipes and the water travels upward through them. The cooler in this latter case must be covered with a house to keep out rain and snow as well as to prevent the oil being blown around by the wind. Coolers of the latter form are easier cleaned and more efficient.

From the coolers the debenzolized wash oil goes to the circulating tank to be again pumped over the scrubbers.

The still should be operated so as to clean the wash oil of aromatics as completely as possible. Good practice will leave from 0.1 to 0.3 of a per cent distilling below 200 deg. C. in the oil returned to the circulating tank.

In plants stripping water gas trouble is experienced by the separation from the wash oil of polymerization products of a gummy nature, and provision should be made for the settling and removal of this sludge from the wash oil. Suitable provision should also be made to remove any water that separates from the wash oil at the scrubbers and in the circulating tank; as water not only spoils the operation of the continuous still, but also lessens the absorption of the aromatics from the gas. The principal sources of this water are:

1. By mist carried forward with the gas when direct gas coolers are used.
2. Condensation from the gas when the temperature of the wash oil is lower than the gas.
3. From wet steam supplied to the continuous still.
4. Condensation from the direct steam supplied to the continuous still when the temperature of the benzolized oil leaving the preheater is too low.

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Ability to Penetrate Dead Gas Layers About Object to be Heated Makes Radiant Heat More Effective than Convected or Direct Contact Heat

J. N. Cadby Discusses Surface Combustion Method of Utilizing Gas—The Idea by No Means New—Its Varied Applications

In these days of unparalleled demands for high efficiency, speed and precision in manufacture, conservation of fuel and of men, stability in financial conditions and thrift and productiveness on every hand, we are called upon to meet these demands by considering and planning with all the wisdom and ingenuity at our command, declared J. N. Cadby, in his paper on "The Commercial Application of the So-Called Surface Combustion Method of Utilizing Gas," presented at the recent annual meeting of the Illinois Gas Association. The public utility men have a large part in working out the problems of the nation, and 1918 will probably be the busiest year our association has known. Under these circumstances I feel that I would be imposing upon you if I failed to present something that was of real assistance to some of you in meeting the 1918 problems, I have therefore selected a subject which is closely related to manufacture of war supplies and munitions as well as the sale of gas.

Load Factor of Unusual Pertinency

I have had no part in developing surface combustion equipment, my only interest in it is that of the interested observer of what others have done, just as the rest of you are interested in any equipment that may increase your business and that of your local manufacturers. Many of your industrial consumers and prospects that you have never succeeded in connecting up to your system will be glad to find a reliable, economical, continuous and clean source of heat, easily regulated and without the attendant difficulties of securing and storing solid or liquid fuels or keeping large sums of money and valuable space tied up with fuel investments. The question of load factor has received little attention in the gas business since gas for cooking first became popular, but it is better to increase your sales during hours of small consumption than to have only a cooking and lighting load. Who knows but that before long the combined gas and electric property supplied from a transmission line will use this apparatus as a reserve to bring a boiler up to steam pressure in a very few minutes and carry the load until the ordinary coal boiler can do so? With these points in mind, we will proceed to discuss the so-called "surface combustion" equipment.

Few Things Really New in the Gas Industry

There are very few things that are really new, particularly in the gas business. A few weeks ago I saw a gas-heated galvanizing bath, which was so different from any other gas installation that I had seen that I thought that a very new application of gas had been developed. A little study, however, shows that this is based on old, well-established principles of combustion, and that the modifications and steps in the development of this particular class of apparatus has covered quite a number of years. Although we are not very familiar with this equipment in this part of the country, refer-

ence to the last page of this paper will indicate that it is now well known among gas manufacturers and large industrial users in the East.

Perhaps the most striking difference between the apparatus of which I speak and the ordinary gas-burning equipment is that here the gas is burned inside a combustion chamber, with but a limited amount of air supplied; the air and gas being mixed in proportions to form an explosive mixture before entering the device. Regulating the supply of air to the flame is as old as the crudest stoves or ovens, and the penetrating qualities of radiant heat have been utilized as long as the sunshine itself.

It is the understanding of the writer that as early as 1900 and 1901 Dr. Charles E. Lucke, professor of Mechanical Engineering at Columbia University, published information relative to this general method of continuous and localized combustion of explosive gas mixtures and that in 1904 he took out the original patents covering the same. Prof. W. A. Bone, of Leith, England, also did important development work along the same line.

In 1911, Professor Bone came to this country and presented a paper describing his experiments (many of which he repeated) at the annual convention of the American Gas Institute held at St. Louis. Much of the early development of the apparatus by these gentlemen was applied to small heating devices for domestic and industrial purposes. The heating of rivets, the melting of solder and other metals, enameling, baking, steel hardening, welding and other heat treatments are now carried on by means of this gas combustion, rather than the solid fuels which have formerly been utilized.

Utilization for Steam Raising

Earlier in 1911 Professor Bone had exhibited a tubular experimental steam boiler at the Royal Institute of Great Britain. This developed a hundred pounds of steam pressure. It had a large diameter, but the tubes were only about 3 ft. long, the gas entering one end of the tubes filled with refractory material and being ignited at the other and burning near the inlet ends. The directing of a gas flame, as distinguished from an explosive gaseous mixture, into refractory materials, surrounding a cooking or melting pot was, I believe, used some time before Dr. Lucke's and Professor Bone's experiments were carried on.

There are many advantages to this general method of utilizing gas for commercial purposes. In the first place, the elimination of excessive air and the complete combustion of all the gas reduces the flue gas losses, develops very high temperatures resulting in an unusually large proportion of radiant heat and gives very high efficiency. The elimination of an excess of air also makes it possible to treat metals with the minimum of oxidation taking place. Burning the gas inside thick-walled combustion chambers also increases the efficiency and aids in the development of very high temperatures. A temperature of 3,000 deg. Fahr. can be obtained by this equipment.

Control of Heat Almost Perfect

With commercial gas of a fairly uniform quality, the control of the heat is almost perfect. A variation of but 5 deg. to 10 deg. Fahr, at temperatures around 2,000 deg. Fahr. can be maintained for an entire twenty-four-hour run, according to tests made by the manufacturers of surface combustion equipment and their customers.

The reason that radiant heat is more effective than the ordinary heating by convection or direct contact with the flame is due to the fact that dead gases surround the object to be heated and fill the vine pores and openings in the surfaces. These gas layers are not easily penetrated by the hot gases, but are more readily penetrated by the radiant heat energy.

Many interesting problems were encountered by the men who developed the apparatus which is now employed for utilizing this general plan of combustion. In the first place, the gas and air mixture is explosive, and must not be allowed to accumulate in large quantities and must not travel slower than the rate of flame propagation at the point of discharge into the furnace, otherwise destructive explosions would take place.

Making Equipment Usable by Ordinary Workmen

Originally the gas and air supply valves were linked together so as to operate simultaneously. However, there was considerable difficulty with this method, as the valves did not have the same relative capacities throughout their entire ranges of operation, thus more or less readjusting was necessary. In order to make the equipment usable by workmen who were not experts on combustion, the mixing devices, described later, have been perfected. In the case of the installation recently examined by the writer, the men in charge of the galvanizing work had no trouble regulating their heat, although they were not informed in regard to the proportions of air and gas to be combined. In this particular installation the valves in the air pipes were turned up or down at will, and the gas supply remained in the proper proportion to the air.

Methods of Supplying Fuel

Two general methods of supplying the fuel for this system are in use to-day. One method consists of utilizing gas at a fairly high pressure, from 6 to 10 lb. per square inch, drawing in the proper proportion of air at the air orifices of the Venturi type controlling device attached to the burner manifold. The other method is to use an air blower, supply the air under pressure and draw a predetermined amount of gas into the mixing pipes within a few feet of the burners. The former method is simpler and less expensive, but as the high-pressure gas is not always available, the other plan is used very often.

Where an air blower is employed the pressure is carried at perhaps 1 to 1¼ lb. per square inch. Higher pressures are not as efficient or desirable. When the air is under pressure, it is put through a device somewhat like the steam injector, which is so adjusted that the proper amount of gas is drawn from the gas supply pipe. The gas and air is then slowed down in the expanding cone of the Venturi mixing device to recover the necessary pressure head for supplying the burners. The diameter of the burner outlet is so reduced that the gas travels through the burner nozzle and for some distance into the combustion chamber at a rate of speed which is somewhat higher than that of flame propagation.

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Discussion at March Meeting of Gas Sales Association of New England Indicates Promising Conditions in the Commercial Departments

The Gas Range, the Gas Company and the Customer—The Workman Holding Down Two Jobs Found to be a Sure Sales Prospect Even in Business Hours—The Effect of the Draft and Enlistments on Gas Appliance Sales

The regular monthly meeting of the Gas Sales Association of New England was held at the Boston City Club, March 8, an extra large attendance being present.

After dinner the meeting was opened by William Gould, governor of the association, who introduced Merle Abbott, sales manager of the Weir Stove Company, as the speaker of the evening. Mr. Abbott read the following paper on "The Gas Range, the Gas Company and the Customer":

Saving in Coal by Cooking with Gas

"When requested by directors of the Gas Sales Association to write a paper, the subject of which was to be 'The Gas Range, Its Present and Future Relations to Gas Companies and the Customer,' I hardly realized the difficult task before me, although after recalling the many interviews with various gas men in New England, it then occurred to me that there was a marked difference of opinion as to the policy their respective companies should follow in regard to commercial activity. This, within itself, presented a problem with unusual complications.

"I believe that it will be impossible at this time for one to express ideas that would be thoroughly in accord with the majority, and in view of this fact it would seem to be more a

question of local analysis of conditions with the individual companies, and whereby officials and heads of departments should co-operate to the fullest extent in order to determine the most practical course their company should pursue.

"Unquestionably, the time is present when gas companies have before them the greatest opportunity in their existence for promoting the sale of appliances. For when we consider that the conservation of coal has become a subject of national importance, and one of the most serious problems undertaken by the Government, and it has also been demonstrated that the use of gas for domestic purposes, particularly the cook stove, effects an enormous saving in coal, by reason of the fact that conservative estimate, it requires three times as much coal burned in a cooking range to do a given amount of cooking as required to make sufficient gas to do the same amount. Also the by-products derived from the manufacture of gas are most necessary to the Government. Assuming that these figures are reasonably correct, can it be doubted then that the gas range is one of the most effective mediums through which this great saving for the Government can be realized?

Government Advocacy

"I understand that the Fuel Administration and Food Administration at Washington and in many States have been presented with the above data from various sources, requesting that they confirm this claim of greater coal economy in the use of gas, as against any other fuel for cooking purposes, and that they advocate its use by families, restaurants and hotels.

"Another point I will cite in favor of the gas range. Mr. Storrow, Fuel Administrator of Massachusetts, in a recent statement intimated that seri-

ous suffering would be experienced unless domestic consumption of coal was reduced by at least 20 per cent. We could go enumerating reasons, from a patriotic and domestic standpoint, why the installation of the gas range, at this time more than ever, should be strongly advocated; for example:

"1. It is within reach of modest incomes.

"2. Simplicity of operation, which embodies comfort, service and convenience.

"3. Economy in operation.

"4. Cleanliness (no coal ashes or dust) in the kitchen.

Cooking with Gas a Habit That Lasts

"The gas range goes into the home to stay. Cooking with gas, gentlemen, is a habit that lasts.

"It is questionable whether or not the abnormal business enjoyed by gas companies at present will continue after the war unless they now take advantage of the remarkable opportunity presented by the necessity for the conservation of fuel and the nation-wide advertising of this fact by the Government. As I have said above, cooking by gas is a habit that lasts, and if we take advantage at this time to push the gas range, we are installing the survival of the fittest means of cooking. Replacements by gas ranges where coal ranges have been in use means revenue for years to come for the gas company.

Companies Unnecessarily Alarmed—Perhaps

"We must admit that gas companies have been operating under tremendous strain for some time past. Their inability to procure crude materials in sufficient quantities to guarantee a production of gas, to meet the abnormal demands of their customers, has been annoying, to say the least.

"Then, again, the increased price of gas-making materials without increased revenue, by rate advance to offset it, has been another discouraging factor.

"No doubt, in some cases, these facts have been responsible for retrenchment in new business departments, thereby curtailing the sale of gas ranges and other appliances.

"Isn't it true that in some cases gas companies have been unnecessarily alarmed over this situation, as it is certainly to the country's advantage to find ways and means by which the gas companies may continue to give service to the public, not only from an economic standpoint, as previously outlined, but also to keep important industry moving?

"Undoubtedly most of you have read the excerpt from the annual report of the Hon. John Skelton Williams, Comptroller of the Currency, to Congress regarding the serious financial condition of all public utilities and recommending immediate action; also the letter of the Secretary of the Treasury to the President, dated Feb. 15, and the President's reply. For those who have not read these letters, I am going to read two paragraphs from President Wilson's letter, which are of vital interest to the gas industry:

"'It is essential that these utilities should be maintained at their maximum efficiency, and that everything reasonably possible should be done with that end in view. I hope that State and local authorities, where they have not already done so, will, when the facts are properly laid before them, respond promptly to the necessities of the situation.'

Hysteria Dangerous

"Gentlemen, this ought to make you feel well assured that the Government is vitally interested in your welfare.

"If correctly informed, no New England company has had to shut down because of the shortage of material, and some of our companies have gone ahead in spite of difficulties.

"Hysteria is dangerous, and we must not get hysterical. There are people who say that the luxuries should be curtailed and only the necessities allowed to exist in these times. *Don't forget the fact that there is no such thing as a non-essential industry.* All industries are essential and necessary to the prosperity of the nation and your community, and by these industries being kept going we are keeping the working man at his job and putting money in circulation.

"Of course, in New England, as elsewhere, business will continue to be somewhat spotty. In some sections and some industries there will be hectic activity. However, as a whole this section furnishes so many materials essential to the war and so many others absolutely essential for the needs of the civilian population, that great activity is inevitable.

Difficulties of the Times

"It was gratifying to note that regardless of shutdowns and enforced holidays in recent weeks there have been only two weeks of the entire year to date (and those during the enforced holidays) when the total value of business transactions in New England was not in excess of all previous records in this section.

'I have often wondered what the result would have been had the gas range manufacturers sat back in their chairs and given up hope of obtaining crude materials which were needed to complete pending contracts.

"The manufacturer of gas ranges, as well as the gas man, has had many serious and perplexing problems to face during the past few months. In our particular locality, which is a New Haven railroad point, we were handicapped by one embargo after another, and we found it necessary to exercise extraordinary effort in our endeavor to get material.

"From what was supposed to be good authority, we were told that 'it would be absolutely useless to anticipate the arrival of any shipments within the required time'; consequently, in order to complete the work, it was necessary to resort to methods of transportation heretofore considered impractical, and premiums as high as $16 per ton were paid on pig iron shipped from the South. Similar complications were experienced with shipments of lumber, pipe, sheet metals and other articles used.

Merchandising Efficiently

"We were also obliged to purchase many small lots at fabulous prices in the open market on account of delays occasioned by transportation. The above was done to protect our customers and our own business as well, and the result for the year 1917 was the largest in history, which proves clearly the wisdom of this policy.

"It has been a more or less general policy to market appliances on a very close margin, and in some cases the profit has not been sufficient to cover the installation cost. This practice, however, is fast disappearing. It is now quite generally con-

ceded that the new business departments should be operated at least as nearly as possible on a self-sustaining basis.

More Attention to Displays

"Another step in this direction was made in the report of the committee on gas merchandising, read at our meeting last October, and which was presented very ably by Mr. Pettingill, of Woonsocket.

"I believe also that this could be more readily achieved if greater attention was given to show windows, floor displays, demonstrations, local advertising and a more thorough study of the appliances to be sold.

"It is essential that in offering gas ranges or any other appliance for sale, that a proper demonstration should be made. Even then the greatest results cannot be attained unless the salesman has full knowledge of his proposition, and is enthusiastic about it and makes that impression on the customer. It is my opinion that many sales are lost through poor demonstrations. Business is based on confidence the world over. Confidence, on the part of the salesman, begets it in the customer.

High Prices No Deterrent to Buying

"One gas man with whom I have recently talked was rather pessimistic as to the number of ranges his company would sell during 1918, basing his assumption entirely upon the increased price he would have to charge his customer for a range. While this may be true in a sense, we think this is the proper time to dwell more on the service rendered, and the saving made, through the use of the gas range, and to think less of the price to be charged. We know that people are prosperous, and that they expect to pay more. They not only have the necessities of life, but many luxuries are being added daily to the home. I am told that the talking machine people are far behind on their orders, and also that a class of people are buying them that could never afford to before. Why should you hesitate to place a price on your gas range then that represents a fair profit to your company? The gas range is not a luxury, but a necessity to what we consider a well-regulated home.

Increased Prices and Shorter Payment Terms

"When increasing selling prices on gas ranges, it is well to consider the amount to be paid monthly where sales are made on the instalment plan, and while it is important to keep collections well in hand, it is my idea that increased prices and shorter terms of payments would in some cases impose a real hardship on the purchaser and might be the cause of holding up a sale.

"One of our members stated at a recent meeting of the Gas Sales Association that even though the prices on appliances had been increased considerably, the total sales for his company for the past year had jumped 30 per cent.

"A recent paper read by Mr. West before this association on gas lighting brought out a very strong point in merchandising, which was to the effect that selling depended largely upon how strongly one had the desire to sell, and that the best article on the market could not be sold successfully unless someone had that desire. Gentlemen, have you the desire?

Type of Range to Sell

"Following up the statements already advanced in this paper, the question arises as to which type of range is best to sell. This subject opens up a very wide field for discussion, and can be best covered by arguments advanced from the members present.

"We should endeavor to sell a range of larger capacity than has been customary in the past, for the reason that the gas range will be called upon to do more work as long as the coal situation remains as it is now. As a result of this, the gas range will continue to hold a great amount of this additional work, even when coal conditions become normal, because the customer will become convinced of its great superiority. Additional equipments, which should be included with a gas range, for instance, splashers, lighters, etc., no doubt will have a tendency to popularize its use.

"In conclusion, I am firm in the belief that the gas companies should retain the appliance business, although it may be to their advantage, in many cases, to co-operate with merchants with the idea of increased sales and protection from sales of inferior appliances. There are many reasons in support of this statement, among which are:

"1. The customer depends on the gas company for service regardless who sells the appliance.

"2. It is a fact that more gas appliances are sold when the gas companies are active in the sale of such appliances.

"3. With their knowledge of the gas business, they are in a better position to supply the customer with the appliances best suited to the needs of their customer and to their mutual satisfaction.

"I have tried to bring to your notice the many opportunities that should be taken advantage of at this time, and sincerely hope there will be a wide discussion on the various arguments in this paper, which will be beneficial to us all and helpful in keeping the gas industry growing."

Gas Companies May Be Facing Biggest Business Year Since 1903

A discussion of Mr. Abbott's paper was opened by J. B. Anderson, of the Brockton Gas Light Company, who emphasized the point made by Mr. Abbott of the necessity of the salesman's confidence and knowledge of the appliances he sells. Mr. Anderson said that the Brockton Gas Light Company had taken advantage of the invitation extended by manufacturers and had sent their salesmen to the factories to learn the process of manufacture of the appliances, following this up by lectures by experts from the factory. He further stated that appliances in Brockton were not sold on prices, but merit, and that the price did not make any difference, the salesmen being taught to forget it. He also stated that at this time we ought not to demand of the manufacturers any extras that are not absolutely necessary.

At this point Mr. Gould told the association of the resolution before Congress for an appropriation of $5,000,000, to be placed in the banks for the help of public utilities.

Mr. Woodhead, manager of the Arlington Gas Light Company, spoke on the many good points brought out by Mr. Abbott's paper, and emphasized the statement that show windows and displays should be given more thought and kept clean and up to date. He also stated that Rip Van Winkle should not see the same win-

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Emerging from the Lethargy

The close reader of current events cannot but be struck with the increasing frequency of notices to the effect that this or that gas company has announced its intention to provide enlargements to meet the expected acute demands of next winter.

For a long time construction in the gas field was dead. High costs were the reason.

The high costs are still with us, but however strained our resources we cannot permit them to longer hold back. Gas men to considerable numbers went through an experience during the winter now past that they will not soon forget. Many were those who spent a number of their nights at their desks, terribly anxious nights, with nerves tense and worried minds. There was a reason and the fault was not theirs.

The anxieties were not confined to the little plants, the narrow-margin people. They were experienced by plants that demonstrated that they had capacity sufficient to meet a 60 per cent excess load.

It was an unprecedented condition. But it has occurred once, and it may occur again. Far-sighted gas companies, despite existing conditions, are providing against contingencies.

The Attitude of the Industry Towards Gas for House Heating

The AMERICAN GAS ENGINEERING JOURNAL esteems it a rare privilege to be able to publish in this issue the viewpoints of such gas men as E. C. Jones, Charles M. Cohn, Jacob D. von Maur, E. N. Wrightington and Alfred E. Forstall on the subject of gas for house heating. All of these are men who daily deal with the big problems of the gas industry. They view every phase of each new development. They are thus eminently qualified to offer valuable suggestions in regard to how we are to deal with a branch of the business which had developed in a comparatively short time from what might well be called an auxiliary branch to possibly our greatest problem.

Mr. Jones, as would be expected, unqualifiedly indorses any effort that would make for a greater gas industry, or that would enhance its goodwill. He is not unmindful of obstacles, but his tendency is to brush obstacles aside when a worth-while end is to be attained. Such a spirit is characteristic of youth, and while we admire the boy's spirit we do not always trust his judgment. But Mr. Jones is not exactly a boy—at least not in years. He has been a gas man since 1876, and he has seen quite a number of seemingly insurmountable obstacles surmounted. He has surmounted quite a number himself. Otherwise there might not be to-day very much of a gas industry on the Pacific Coast.

He is, furthermore, as well qualified to speak au-

thoritatively on conditions in the East as he is in the West, being, in fact, a transplanted New Englander, and essentially one of the broad-gauged men of the gas industry.

He is optimistic by nature, but never without reason. He regards house heating by gas as a national duty. He thinks the war will help the gas business, and the gas business will help shorten the war.

He has a vital interest in the attainment of both ends. All his own life has been tied up in the gas business. The name his attainments have earned will live as long as the gas business continues and no longer, and he has a son in the military service in an organization whose name does not indicate it will be building wharves at some seaport while there is fighting going on at the front.

Mr. Jones' communication can be styled almost a complete indorsement of the stand the AMERICAN GAS ENGINEERING JOURNAL has taken on the house-heating question. A more authoritative indorsement we could not ask.

Mr. Cohn does not discourage the efforts the JOURNAL has urged, but he sees clearly the difficulties in the way. He does not say not to go forward, but he advises watching each step. The question of financing and rates of return, the question of finding summer loads, to keep the surplus capacity an extensive house-heating load would otherwise leave idle, working all the year are all important.

These are timely and necessary warnings. Doubtless they have at all times been kept carefully in mind by the Baltimore company, and the Baltimore company, we believe, has gone into the house-heating business more ambitiously than any other company, in proportion to its size, in the country.

Considering the gruelling experiences the New England companies have gone through during the past winter, Mr. Wrightington's letter reveals a fine degree of courage and hopefulness.

The AMERICAN GAS ENGINEERING JOURNAL, itself, has never advocated, except in special cases, complete house heating by gas, though various of its contributors have.

The JOURNAL's attitude has been that the ideal would be attained when all the *fuel* used for house heating was produced by the gas company. By this we mean gas and coke.

Consequently, Mr. Wrightington's viewpoint and ours are not far apart. He believes in gas for auxiliary heating, intermittent heating, spring and fall heating, etc. So do we. Our complaint has been that many

gas companies were remiss in properly pushing appliance sales even for such purposes. The Boston Consolidated was not one of them, however. More than once we have had occasion to admire the manner in which this company was discharging its mission despite what seemed to us adverse conditions. This is a company that did not endeavor to hold down its output by discouraging the *use* of gas, but, on the contrary, by such means as free distribution of Welsbach lamps to eliminate the open-flame burner.

Mr. von Maur's communication is in the nature of a very comprehensive outline of the objections on the part of the industry to house-heating business, and reveals a wealth of sound common sense. Mr. von Maur doesn't state whether or not he would go out of his way very much to get such a load, but since the demand exists he is emphatic in his belief that it should be met. He does not consider that it is an outrage on the gas company that people who are cold should use gas to get warm. He plainly is more interested in finding a way to meet the demand than he is in finding a means of disclaiming the gas industry's responsibility to supply gas for such purposes.

Mr. Forstall does not believe house-heating business will be profitable to the gas company unless a special rate is made to meet it.

The question of profits on any branch of the business in the gas industry just now is highly involved. Some companies have had relief in rates, others have not, despite the fact that their costs have gone up tremendously.

Whether or not gas for house heating, under rational circumstances, could be sold at a profit at the same rate as it is sold for lighting or cooking is another matter. The costliness of house-heating business on a large scale would lie, if suddenly taken on and no provision made to occupy the extra plant it would require during the remainder of the year, in the interest on the investment on the idle plant during the summer months. If an essentially summer load could be built up to balance, there is no reason why gas for house heating should cost any more to serve than gas for cooking. It must be remembered, too, that the cooking load is, to an appreciable extent, seasoned. A good part of the gas ranges on our lines are in use only during the warm months. And our lighting business should, in our own interests, cost us more than it now does.

As a general thing, however, the AMERICAN GAS ENGINEERING JOURNAL believes that gas for all purposes should be charged for in proportion to the cost of service.

N. I. GARRISON, manager of the El Reno Division of the Oklahoma Gas & Electric Company, has been appointed one of a committee of four to supervise the El Reno war gardens.

Hope Is to Double Toluol Production Without Materially Inconveniencing Gas Consumers

(*Continued from page* 320)

The usual absorbent or wash oil used in this country is a petroleum distillate conforming to the following specification:

1. Specific gravity at 18 deg. C. (compared with water at its maximum density) must be as low as possible; but not over 0.875.

2. Viscosity as low as possible, but not over 92 seconds at 70 deg. Fahr. when using a Saybolt A = 185 seconds when using a standard Universal Viscosimeter.

3. Five hundred c.c. of the oil steam distilled at 100 deg. C. with dephlegmater with 0.5 kilo of steam should not yield more than 10 c.c. of distillate. The still should not be heated with direct flame.

4. Steam distillation of the straw oil (as in No. 3) should produce no permanent emulsion. After fifteen minutes there should be no band of emulsified oil between the oil and water. The line of division should be sharply defined.

5. Must give no distillate below 285 deg. C. (temperature of oil) on dry distillation.

6. Must not thicken upon cooling to 4 deg. C.

7. Mulsification test: 100 c.c. shaken vigorously in a stoppered 200 c.c. cylinder with 100 c.c. of water, the separation should take place as quickly as possible, 95 per cent at least should separate in ten minutes.

8. Olefines should not lose more than 10 per cent in volume when washed with two and a half times its volume of a mixture of two parts of 93 per cent H_2SO_4 and one part fuming sulphuric acid containing about 25 per cent free SO_3.

The European practice is to use a coal tar heavy oil distilling between 200 deg. and 300 deg. at least 90 per cent, and which does not deposit more than 12 per cent naphthalin in all fractions after standing twenty-four hours; Sp. Gr. 103 deg. to 105 deg. at 15½ deg C., or a blast furnace oil which distills at least 85 per cent between 200 and 300 deg. C.

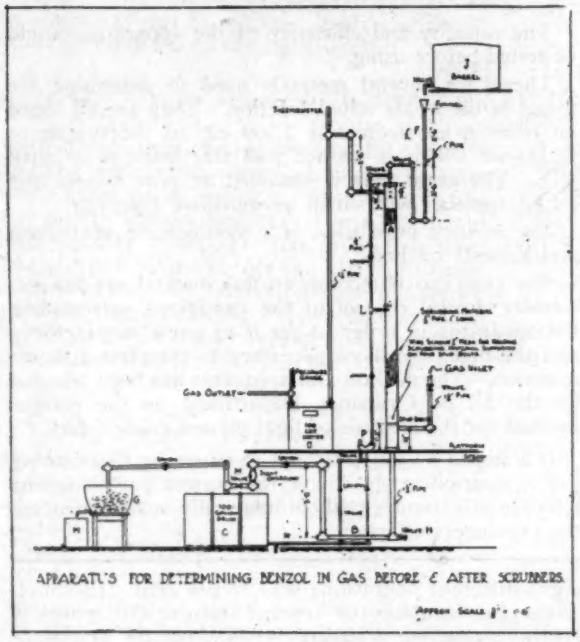
The light oil produced should distill 65 to 70 per cent at 100 deg. C. and 85 to 92 per cent at 200 deg. C. Such light oils would contain from 60 to 75 per cent benzol, 8 to 15 per cent toluol and 4 to 8 per cent xylol.

CRUDE OIL FRACTIONATED IN A COLUMN

The crude light oil is fractioned in a column still with the same equipment as for the production of pure products. There should be at least 10 in. between plates in the column of this still so that material may not be carried forward as a spray, and provision made so that the column will drain between charges.

Crude benzol fraction is frequently used with an admixture of about 3 per cent of crude solvent naphtha to enrich the stripped gas, toluol fraction only being reserved for sale.

Where such is the case it is necessary to make a crude benzol fraction dry below 100 deg. C., and preferably below 90 deg. C., in order to keep toluol from the enriching fraction. This is accomplished by operating the still so that the dry point is kept below 100 deg. C. during the crude benzol fraction and taking intermedi-



APPARATUS FOR DETERMINING BENZOL IN GAS BEFORE & AFTER SCRUBBERS

8

ate fractions, which are rerun between crude benzol and crude toluol and after crude toluol.

The cut should be made to crude intermediate benzol when a test of the distillate from the worm shows the dry point at 100 deg. C., and to crude toluol when the test shows first drop at 100 deg. C.

The cut from crude toluol to crude intermediate toluol should be made when the distillate shows about 50 per cent to 125 deg. C., and to crude solvent naphtha when the test shows first drop at 130 deg. C.

The intermediate fractions are rerun, using the same cuts as for the original light oil.

The residue from the crude boiler still, after the distillation is finished, is run to the residue tank RT and pumped to the naphthalene pan, where on cooling the naphthalene crystallizes.

The mother liquor from the naphthalene crystals is drained to the wash oil circulating tank; the crude naphthalene crystals are dried by draining and sometimes in a centrifugal when they are ready for shipment.

Crude Benzol to Enrich Gas

The crude benzol either alone or mixed with the naphtha in the proportion they are produced is frequently used to enrich the stripped gas. This is accomplished by a vaporizer where the oil is heated and mixed with a portion of the gas. The rich mixture thus produced is led into the lean gas main, where it mixes with the total volume of gas.

The control tests necessary to insure proper operation of a plant such as has been described are:

Candle-power and calorific value of gas, both entering and leaving the scrubbers.

Light oil in gas both entering and leaving the scrubbers.

Light oil in wash oil to continuous still.

Light oil in wash oil from the continuous still.

Examination of new wash oil received: Specific gravity, viscosity, emulsification, steam distillation, dry distillation, olefines, thickening at 4 deg. C.

Distillation test of light oil produced with determination of loss and residue above 200 deg. C.

Distillation of frequent samples of distillate to control fractions.

Distillation of samples from storage tanks and residues.

I need say nothing about the calorimeter and candle-power tests to gas men. There is, however, much difference of opinion upon the test for light oil in gas.

The most common method is to pass a measured volume of gas through a train of bottles containing an absorbent oil; various oils are used—paraffin oil, oleaic acid and cottonseed oil are among those proposed.

A modified lessing scrubber has come into favor of late as the standard apparatus to test for scrubber efficiency. The illustration shows the apparatus as used by the Chemical Service Laboratories.

Standard test for scrubber efficiency:

Scrubber "A" in the accompanying drawing is made of a 12-ft. length of 6-in. wrought-iron pipe closed at top and bottom with caps, preferably welded on in order to insure against leakage. The bottom cap is tapped in the center to receive 1-in. pipe. The following taps are also made in the column: One 1¼-in. tap 12 in. from bottom; one 1¼-in. tap 5 in. below top and 180 deg. from bottom tap; one ¾-in. tap at center of column.

The column is filled to within 1 ft. of the gas outlet pipe with 1-in. lengths of ¾-in. pipe. The filling material rests on a heavy wire screen held in position by stud bolts placed 2 in. above the gas inlet pipe.

A pump is provided to circulate oil at the rate of 2 to 3 gal. per minute.

The piping necessary for assembling and connecting up the apparatus is clearly shown on the drawing and needs no special explanation.

The apparatus should be located as near as possible to the gas main from which the sample is drawn, the gas from the outlet of the meter passing back into the system or preferably to a bleeder where it may be burnt or otherwise disposed of. The scrubber should be lagged, and if possible placed in a location where it will not be subjected to extreme ranges in temperature. In connecting the apparatus to the supply main, precaution should be taken to prevent deposition of oil in the pipe leading to the apparatus, due to falling off in temperature at this point. In some situations it may be necessary to lag the pipe or even to steam-jacket it.

The apparatus is designed to handle up to 300 cu. ft. of unscrubbed gas per hour, and in most cases it will be found quite sufficient to circulate oil continuously during the duration of the test into the top of the scrubber. The apparatus, however, is provided with an oil storage tank "J," containing fresh oil, which may be continuously added during the test, at the same time circulating oil from drum through the lower half of scrubber through inlet "L." Fifty gallons of scrubbing oil is sufficient to secure a sample of from 1 to 1½ gal. of light oil, therefore, having passed through the apparatus a sufficient quantity of gas to secure the required amount of light oil, the pump is stopped and the column allowed to drain into the 100-gal. drum. The oil remaining in the seal "B" is drawn off at valve "K" and added to the bulk of the oil in the drum. Valve "M" is then closed and direct steam admitted into the drum at "N."

The light oil vapors are carried forward into cooling coil "G," and the condensed oil is received in vessel "H."

The distillation is continued until no further appreciable quantity of light oil comes over. The water which comes over with the light oil is drawn off from time to time through the draw-off cock on vessel "H." Cold water should be circulated around the condenser coil during the progress of the distillation, entering at the bottom of the tub and overflowing at an outlet placed near the top. The recovered oil is measured and calculated to volume per 1,000 ft. of corrected gas passed, as shown by the meter. As a considerable quantity of water will be condensed in the drum during the steam distillation, it is necessary to draw this off through the cock provided for the purpose at the bottom before making succeeding tests. If it is found necessary to use oil from tank "J," a connection from the pump, not shown on drawing, should be provided to handle the scrubbing oil into this container.

The oil to be used in making the test is cottonseed oil.

The capacity and efficiency of the apparatus should be tested before using.

There are several methods used to determine the toluol in the crude toluol fraction. They are all based on refining approximately 1,500 c.c. of the sample to be tested, which is washed and fractioned in a small still. The large part is obtained as pure benzol and toluol, together with small intermediate fractions.

The method most used is a modification of Wilson and Roberts method.

The principal objections to this method are the extremely careful control of the conditions surrounding the apparatus in order to get it to work satisfactorily and the time, two days, necessary to complete a determination. The method and apparatus has been adopted by the U. S. Ordnance Department as the referee method for the analysis of light oil and crude toluol.

It is hoped by stripping and re-enriching illuminating gas to approximately double the present production of toluol in this country without materially inconveniencing the consumers of gas.

Industrial Lighting a Field of Wide Opportunity That Presents No Obstacle That Energy and Intelligence Cannot Surmount

(*Continued from page* 318)

Hygienic and Labor Efficiency Not One and the Same Thing as Related to Illumination Intensities

The immediate consideration in factory lighting regulations is, therefore, to maintain such lighting conditions as shall be most favorable to comfortable vision and freedom from deleterious effects. The conditions under which maximum production efficiency is attainable usually involve illumination intensities much higher than those which are merely safe from a hygienic point of view. In conforming to the factory lighting his own interests dictate. It may be that an increase of, say, 100 per cent or 200 per cent over the requirements would be far more profitable, and herein lies one of the greatest opportunities of the central station and gas company.

Plants That Must Remodel Lighting Equipment

In many industrial plants the existing lighting is below the legal requirements. When remodeling to meet the provisions of the code is under consideration it should be emphasized to the manufacturer that in barely meeting the requirements he is losing an opportunity to make a highly profitable improvement in the efficiency of his plant. The cost of what has heretofore been considered good lighting is usually in the neighborhood of two-thirds of 1 per cent of the payroll. Recent tests in the machine shop of a large manufacturing concern (conducted co-jointly by the manufacturer and the Commonwealth Edison Company of Chicago) indicated that tripling the usual illumination intensities (an increase from 4-ft. candles to 12-ft. candles) increased production from 8 to 27 per cent in lighting cost, amounting to 1.2 per cent of the payroll, the output was increased from 8 to 27 per cent. The average increase in eight different operations was 15 per cent. In short, if the gas company or central station will render a really competent lighting service to the manufacturer it will not only greatly benefit the latter but may be recompensed by an increase of as much as 200 per cent in its existing factory lighting business.

Legal Requirements Must Be Workable

Legal requirements in order to be effective must be workable, and in order to be workable must be simple. To secure simplicity a certain compromise must be made with wide applicability and universal effectiveness. The fact that a certain lighting installation conforms exactly to the legal requirements does not necessarily mean that it will furnish good lighting. There are circumstances under which a well-designed system furnishing an illumination far below the legal standard may be infinitely better than a poorly designed system with which the intensity is far above the provisions of the code. In certain textile operations an illumination of ¼-ft. candles from below has been found satisfactory when 20-ft. candles from above were inadequate. The enforcement of a legal standard simply insures conditions under which the chances of securing satisfactory lighting are tremendously greater than without such standards. They in no wise reduce the necessity for expert assistance in the solution of lighting problems, but rather make a close study of lighting practice all the more necessary in order to secure the hoped-for results from additional outlays of money.

Before leaving the subject of legal standards it may be well to touch upon one question which appears to mystify a great many people—the relative intensities required by daylight and artificial light. It has often been noted that 3 or 4 ft. candles by artificial light seemed quite satisfactory for which could not be comfortably done by daylight when the latter fell below, say, 20-ft. candles.

This has given rise to a good deal of maudlin prattle regarding the alleged different "qualities" of illuminants. As a matter of fact, the whole matter is

clear and simple as can be without ascribing occult or supernatural qualities to the light itself.

Relation of Contrast to Degree of Illumination

It is well known that the higher the illumination the smaller the contrast that may be detected by the eye. On the other hand, daylight, diffused from the entire sky, nearly always produces (on a given object) much smaller contracts than are customary with artificial light. An average intensity of illumination in interiors is, say, about one one-hundredth of that indoors under daylight. If we take artificial interior lighting as 1 we may represent the smallest detectable contrast (in per cent) at different intensities, as follows:

Intensity		Per Cent Contrast Noticeable
1/10		8
1	(interior, night)	3¾
10		2
100	(interior, day)	1¾

Now, suppose that in a given case the diffusion of daylight is such that an irregularity in the contour (an edge or cut) is just 1¾ per cent darker than its surroundings, while under artificial light it is, say, 5 per cent darker, it will be seen with a day illumination of 100 but will disappear at 10, since at this intensity a contrast of 2 per cent is necessary for visibility. But under artificial light it will be plainly visible at an intensity of 1, because the contrast is 5 per cent—much greater than the 3¾ per cent required at this level. Of course, the ordinary systems of artificial lighting are markedly inferior to properly directed daylight in many other and perhaps more important respects.

How Can Industrial Lighting Be Obtained?

The most important commercial question to which all others lead is, How can industrial lighting be obtained? The first consideration in the sale of service is the value of the service to the consumer. What is the service you have to offer the manufacturer? Is it simply gas of light quality and a distribution service to deliver it at constant pressure? Is it merely this plus the best appliances the market affords? Or is it nothing but these two plus salesmen of pleasing personality, with a repertoire of good stories and a habit of putting "pep" in their arguments? Let us suppose that you furnish the best of gas under the best of conditions, sell the best of appliances, and employ only salesmen who are perfect composites of John Drew, Lew Dockstader and Theodore Roosevelt. What will be your chances of success against a competitor whose service is only fair but whose salesmen are not salesmen only but men who are able to give really good advice as to how maximum increase of production may be secured at minimum expense? Under these conditions I think that any man who knows anything whatever about selling to industrial plants would say that your chances of success are precisely equal to those of a celluloid dog chasing an asbestos cat through Hades.

Men Who Must Be Sold

In selling to industrial plants you must approach men who are, either by training or by practice, engineers, whose whole concern and interest is keeping output up and expense down and are usually pretty competent judges of how to do it. They are not in the least interested in the amiability or entertaining abilities of your salesmen, and do not care whether they put "pep" in their arguments or not. The blandishments that open the pocketbook of the housewife and merchant are shed like water from a duck's back by these men whose whole training has been in contact with definite demonstrable facts and has involved the definite, orderly and logical arrangement of these facts. There are dozens of industrial concerns in the United States which maintain far more elaborate laboratories for the testing of lighting appliances than will be found in any central station or gas company in the country with possibly two exceptions, and in general it will be found that the electrical engineer of a large manufacturing plant knows a great deal more about lighting than the salesmen who call upon him. This knowledge is largely derived, directly or indirectly, from the publications of the large incandescent lamp manufacturing concerns. This can be verified by noting how closely lighting practice in the more modern plants conforms to the practice advocated by the lamp manufacturers. Under these circumstances it is obvious that salesmanship of the usual sort—the pep, punch and personality kind—is simply a waste of time and effort. Unless your salesmen can enter a manufacturing plant and tell the works engineer something that he wishes to know but does not know about more effective and economical lighting, they had better save their breath. The day has gone when a salesman could stick up a lamp, strike an admiring attitude, say, "Gosh, ain't it a wonderful light?" and get an order. It simply isn't being done in the best industrial circles—that's all. That sort of thing goes very nicely with the housewife and the small merchant, but the works engineer is usually of a different breed of cats, as those who try to "sell" him soon find out.

Self-Education for the Factory-Lighting Salesman

How can the salesman acquire the knowledge which will enable him to be of real use to the industrial plant, and thus expect, other things being equal, to succeed in obtaining lighting business? At this point I presume it would be highly agreeable if I should devote a few minutes to a statement of principles which, imparted to the salesman, would enable him to solve any lighting problem instantly and accurately. I am sorry to say that it cannot be done. You would hardly expect a physician to impart to you in an hour's conversation the knowledge that would make you able to diagnose and cure any disease known to medical science, and the field of lighting is scarcely less varied and complex. Furthermore, there is such a vast amount of valuable material already in print, and obtainable gratis, that reworking even a portion of the field seems a waste of time. True, much of this material was prepared in connection with electric lamps, but since gas

lamps are available which are suitable for almost any type of installation, it is easy to utilize this material by bearing in mind a few simple rules for the conversion of electric units into corresponding gas units.

One of the most practical and simple handbooks on industrial lighting is that issued last year by the industrial commission of Wisconsin.

The following table will help the salesman to select gas units corresponding to the electric units described in this handbook:

TABLE I

Mazda Type B		Mazda Type C		Welsbach Gas Lamps No. Per			
Watts	Lum.	Watts	Lum.	Reflex	Hr.	Watts*	Lum.
25	230						
40	378						
60	585	75	865	3	3	483	900
100	1,010	100	1,260	2	5	805	1,500
		150	2,050	20	9	1,449	1,980
		200	2,920	1,911	17	2,731	3,300
		300	4,850				
		400	6,150				
		500	8,050				
		750	12,800				
		1,000	18,000				

*Based upon gas of 550 B.t.u. per cubic foot.

(*Continued on page* 338)

Ability to Penetrate Dead Gas Layers About Body to be Heated Makes Radiant Head More Effective than Converted or Direct Contact Heat

(*Continued from page* 322)

SLOWING DOWN THE GASEOUS MIXTURE

Years ago the method of slowing down the gaseous mixture after it left the discharge orifice so that it could be burned, was to pass it up through a layer of porous material in which combustion occurred. Difficulty was encountered with this arrangement because either the porous material or the object being heated would occasionally melt or break and fall into the burner orifices, clogging the same and causing backfiring. The newer devices, therefore, have the burner pipe enter the wall of the combustion chamber somewhat above a pile of refractory material and to one side of it. The incoming air-gas mixture is directed downward at an angle until it strikes the refractory bed consisting of carborundum crystals or other material capable of withstanding the high temperatures. The mixture then spreads over the surface of the refractory bed or may pass for some little distance into the bed and combustion takes place with only a slight flame where the flow velocity has been sufficiently reduced.

The entire inside of the combustion chamber reaches a very high temperature, and for this reason it is necessary to provide some means of cooling the tip of the burner, although this is sheltered to some extent by being in a slight recess in the wall. The cooling is accomplished by making the burner tube heavy enough to transmit the heat to the outside of the wall, where large flanges are installed for the purpose of radiating this heat into the room.

This material is presented to the gas men of the State, not as advertising any particular manufacturer's equipment, but to point out the interesting features of this scientific application of gas to the industries. It may be that many of you can materially increase your revenues by taking on a factory or two with a very nice load factor. Workmen and those interested in their health and welfare will also be interested in this process, which eliminates so much smoke and fumes from shops where the heat has been applied to forges, ovens and tanks by means of coke or coal fires.

The following list of references to magazine articles gives an idea of the range of application of this equipment:

REFERENCES

Magazine	Date	Process	Installed at	Price of Gas per M.
American Gas Eng. Journal	7-18-17	Welding tool steel face on soft steel for rotary cutter knife	D. Lovejoy & Sons, Lowell, Mass.	About 70c.
Iron Age	8-23-17			
American Gas Eng. Journal	4-7-17	Heating galvanizing bath	Chapman Steel Co., Indianapolis	Ave. 41c.
American Gas Eng. Journal	2-17-17	Oil temperating rifle bodies	Remington Arms Co., Eddystone, Pa.	43c.
Gas Record	10-11-16			
American Gas Eng. Journal	5-19-17	Coffee roaster		$1.00
American Gas Eng. Journal	8-4-17	Flash annealing large projectiles	Midvale	
American Gas Eng. Journal	7-21-17	Bolt forging—continuous	Buffalo Bolt Co., N. Tonawanda, N. Y.	3c.-150 B.t.u. Producer
Gas Record	8-9-16	Heat treating of shells	Eddystone Ammunition Corp., Eddystone, Pa.	Ave. 43c.
American Gas Light Journal	8-21-16			
Metallurgical and Chem. Eng.	9-15-16			
Journal Ind. and Engr. Chem.	10-16			
American Gas Eng. Journal	1-13-17	Heating lead for electrotype	New York	.80
				.80
American Gas Eng. Journal	1-27-17	Making varnish		.60
				1.08
American Gas Eng. Journal		Oil cracking	Standard Oil	.80
American Gas Eng. Journal	9-29-17	Small steel forging	Enterprise Mfg. Co., Philadelphia, Pa.	1.00
American Gas Light Journal	11-27-16	Bakery	New York	.80
American Gas Eng. Journal	4-28-17	Optical Pyrometer Calibrating Furnace (Max. Temp. 3000 deg. Fahr.)	Thwing Instrument Co., Philadelphia, Pa.	1.00
The Iron Age	12-13-17	Tin plating	Bethlehem Steel Co., Sparrows Pt., Md.	
Pacific Coast Marine Review		Shipyard furnace	Pusey & Jones Co., Wilmington, Del.	.60
The Iron Age	2-7-18			

NEWS OF THE GAS INDUSTRY

New Jersey and Pennsylvania Gas Associations Will Hold Joint Convention

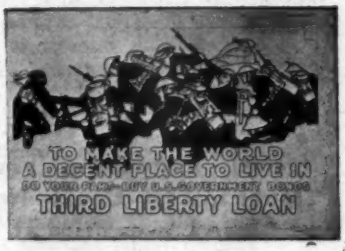
The New Jersey State Gas Association will meet in conjunction with the Pennsylvania Gas Association April 10, 1918, at the Hotel Adelphia, Thirteenth and Chestnut Streets, Philadelphia, Pa.

City of Chicago's Right to Set Rate May Go to Illinois State Supreme Court

That the question of whether the city of Chicago has the legal right to set gas rates may be brought before the Illinois State Supreme Court at the spring session was indicated last week in the course of a Circuit Court hearing on the test suit of James S. Sutter, an individual gas consumer, for a refund of $11.53 as alleged overcharges by the Peoples Gas Light & Coke Company, of Chicago, under the ordinance of 1911.

This same question is the point at issue in the suit for the refund of $11,000,000 in alleged overcharges filed by the city of Chicago against the gas company. The gas company's contention is that the State law of 1905, which gave the city the right to fix gas rates, is unconstitutional.

On the request of attorneys for the gas company and over the protest of Attorney Donald R. Richberg, for the city, Circuit Judge Leo J. Doyle decided to hear the case of Mr. Sutter. This, attorneys for the gas company believe, will enable them to bring the case before the Supreme Court at its next session, whereas the litigation over the alleged $11,000,000 overcharge has become so complicated it is doubtful if that case can be brought to the Supreme Court for some time.



The suit for a refund of $11.53 is backed by the Gas Consumers' League, a new and more or less unidentified organization whose ostensible purpose is to try to obtain refunds for individual consumers without waiting for the outcome of the suit which the city has undertaken "on behalf of the gas consumers."

Citizens Company Rate Increase Suspended Until June 30

The public utilities commission recently suspended to June 30, 1918, the proposed advance in gas rates for La Salle and Peru, Ill., which were presented to the board by the Citizens Lighting Company.

Contract for Supply of Street Lighting Awarded

The contract for supplying gas for the street lamps and municipal buildings was given to the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., at a recent meeting of the board of awards. With the exception of service connections, the prices remain unchanged.

The city has 12,472 gas lamps in service on the streets and in the alleys, and its annual gas bill aggregates $105,000.

THE PROVIDENCE (R. I.) GAS COMPANY has declared the regular quarterly dividend of 2 per cent on its capital stock, payable April 1 to shareholders of record March 20.

St. Louis to Vote on Gas Company Franchise

The city council voted to submit to the voters of St. Louis, Mo., at the coming election the proposition of granting the Laclede Gas Light Company an amendment to its franchise whereby the price of gas will be fixed by a sliding scale, based on the price of coal. The maximum rate would be $1.40 per 1,000 ft.

Inferior Gas Not Atlanta Company's Fault Expert Claims

The Atlanta Gas Light Company was not to blame for the very poor gas it sold its customers a few weeks ago, according to the report of R. S. McBride, associate chemist of the United States Bureau of Standards, who recently investigated the Atlanta situation at the request of the railroad commission, and whose report to that body has just been received and made public. The report covers thirty-two typewritten pages and goes into the Atlanta situation thoroughly.

Mr. McBride states that the poor gas was entirely due to the gas company's inability to secure sufficient gas oil to keep the gas up to the standard of 600 B.t.u. per 1,000 cu. ft., which it has always maintained in the past. He states that he carefully examined the company's files and found that it had made every possible effort, regardless of expense, to get gas oil. The trouble was not a shortage of oil, but a shortage of transportation caused by the Government commandeering tank steamers. The gas oil comes from Texas and Mexican ports.

Mr. McBride states that the gas company was confronted with the choice of making very lean gas or none at all, and chose the former.

As to the gas plant, he states

that it needs some repairs which the company was planning, but he believes building conditions at this time justify the company in postponing them, since they are not absolutely necessary. He states that the plant is operated with reasonable efficiency.

Mr. McBride recommends that the railroad commission establish a monthly average standard of 600 B.t.u. per 1,000 cu. ft. and never let the gas company go below a minimum of 520 units. Gas below this mark is not usable, although Atlanta's gas went as low as 450 units or lower at the lowest ebb of the recent trouble. He recommends the enforcement of a limit on the use of gas if the company should run out of gas oil again, instead of trying to make a small supply of oil go further than it can go.

However, he believes the new priority orders of the Fuel Administration, placing gas oil fifth on the list of transportation necessities, will prevent a shortage occurring again.

As to paying a rebate to customers on their bills for the period of the recent shortage, Mr. McBride makes no recommendation. He says he did not have time to analyze all the factors of this question. He leaves it to the railroad commission.

Red Jacket to be Headquarters for Calumet Company

The Calumet Gas Company, offices of which are located on Hecla Street, Laurium, Mich., has leased office rooms in the Sauer Building, Red Jacket, Mich., and will occupy them shortly. The Laurium offices will be closed.

Cincinnati Company Wants Permission to Issue Notes

The Union Gas & Electric Company filed application with the Ohio Public Utilities Commission at Columbus for permission to issue $1,582,358 two-year 6 per cent notes to raise funds to complete the company's new generating plant and substations.

The company also asked permission to issue $2,134,500 bonds as collateral for the notes. The notes will be sold at 94.77.

Natural Gas Development at Brownwood Arouses Interest

A test was made of the Magee gas well, 15 miles southwest of Brownwood, Texas, recently, two gas sand strata being tested. The sand found at 456 ft. developed a flow of 2,000,000 ft. daily, while the deeper sand, at about 1,200 ft., showed a rock pressure of 500 lb. and a capacity of 8,000,000 cu. ft. of gas daily. A second well is to be drilled at once near the gasser. Much interest is now centering in the development of the gas fields of Brownwood.

Special Committee Finds Municipality Could Not Make Lower Price at Grand Rapids

The city will not at this time consider municipal ownership of the Grand Rapids Gas Light Company's property. This will be the determination of the special committee which has been investigating the gas company's raise from 80 to 95 cents per 1,000 cu. ft. of gas. The committee consists of Mayor P. C. Fuller, City Manager Gaylord Cummin and Commissioner Daniel Kelley. The report will go to the commission very shortly.

Figures submitted by the company, which were taken from the operating cost books and which have been considered by the committee for several weeks, together with a close study of the Newbigging report obtained by a former city adminstration when the municipal ownership of the gas plant originally was advocated, show conclusively that the city could not operate the plant any cheaper, if as cheaply, as it now is being operated and sell gas under present prices.

The committee will point out, first, that the increase is justified, on the basis of the company's operation for the last year and, second, that the basis of the February cost of operation, which shows the continued increase in cost of materials entering into gas production, together with the statistics advanced by Newbigging at a period when materials were normally priced, would, under municipal ownership, boost the gas price to at least $1.07 per 1,000 cu. ft.

The February cost of gas production was 83 cents. The city could not hope to produce it any cheaper, if as cheap. Added to this would be the interest on investment and the sinking fund charges, which represent fixed charges and which would amount to almost 24 cents additional on bonded loans of thirty years which the city would have to float in event of municipal ownership.

None of the committee so far has cared to discuss the proposed report in detail. Figures from the gas company show conclusively, however, that since last May the production cost of gas has increased steadily and that during January the cost of production had mounted to 79.5 cents per 1,000 cu. ft. On that basis no dividends on the stock or the investment could be declared and the February cost, which mounted to more than the gas sold for, forced the company to dip into its reserve.

Appointments to be Made to Gas Defense Service

During the present war the Secretary of War has been authorized by the President to make appointments to the various positions in the gas defense service, except those in the Washington office, without regard to civil service requirements. This is purely an emergency measure, and will be revoked as soon as the necessity has passed.

Manchester Company Asks for Increased Rate

The increasing cost in operating expenses during the last two years, together with the increase in the cost of fuel, oil and other commodities entering into the manufacture and distribution of gas, are termed as the reasons for the asking of higher rates to consumers by the People's Gas Light Company, Manchester, N. H. The hearing which the public service commission will give the company on the increase rates proposal was to be held in the city hall building Feb. 26.

The announcement of the company is that prices for its necessities have increased nearly 100 per cent since 1916, or over $77,000 since that time. These costs cannot be offset at present charges, it is pointed out, and the relief it seeks is by the increase.

The company has not set any fixed amount in the advance in price, leaving it to the commission to establish.

Personal Notes

EARL J. MENEREY, assistant superintendent of the Lansing (Mich.) Fuel & Gas Company, recently left Lansing to accept the superintendency of the Freeport (Ill.) Gas Company.

EARL SMITH, superintendent of the Freeport (Ill.) Gas Company, has been transferred to Lansing, Mich., where he will assume the duties of assistant superintendent for the Lansing Fuel & Gas Company. The change was made at the request of Mr. Smith, whose home was formerly at Lansing, and he desired to return there because his family are residents of that city.

WILLIAM MCKELVEY MARPLE, aged sixty-six years, for twenty-eight years chief engineer for the Scranton (Pa.) Gas & Water Company, died March 20, at his home, 423 Jefferson Avenue. Mr. Marple had been an invalid since 1913, and for the past year had practically been confined to his bed. He was born Dec. 7, 1852, at Wellsboro, Pa. He was a valued employee of the Scranton company for more than thirty years. Mr. Marple was a past president of the Scranton Engineering Club and a member of the American Society of Civil Engineers.

JAMES F. CRAY, of Turners Falls, for the past six years salesman for the Greenfield (Mass.) Gas Light Company, has recently left for the Middle West, where he has taken a similar position with a large public corporation.

Construction Notes

Construction of New Main at Tonawanda Soon to be Started

With a continuation of the prevailing weather conditions, the Niagara Light & Power Company expects that its pipe line between the city of Tonawanda, N. Y., and the Semet-Solvay plant on the River Road in the town of Tonawanda will soon be started. The main will be rushed to completion, after which the company anticipates that the consumers will have an adequate supply of gas at all times.

Luffer & Remick, Buffalo contractors, have been awarded the contract for the construction of the line.

The contractors will also have the job of putting a new line across the Ellicott Creek at Fremont Street. The gas company has made application to the State authorities for permission to put its main under the creek instead of over the bridge at that point. The request has not been acted on.

Discussion at March Meeting of Gas Sales Association of New England Indicates Promising Conditions in the Commercial Departments

(*Continued from page* 325)

dows when coming down the hill that he saw when going up. Mr. Woodhead brought out the fact that the show windows of gas companies were not always attractive, and that we might not be pleased to hear the remarks others passed about them. He also stated that the type of range to be sold was gradually changing, and now, in place of the cooker and small square range, the salesmen were selling cabinet ranges.

Mr. Nute, of Fall River, spoke in part as to the critical condition that gas companies were in at the present time, speaking of the acuteness of the coal and oil situation. He said that if gas companies were able to get their supplies of coal and oil for the coming year that they would have the greatest business year since 1902 and 1903, the time of the great coal strike. He said that the total coal supply for 1917 was 630,000,000 tons, and that he was informed through war committees that this amount would not be increased in 1918, and that the railroads and war manufacturers alone were credited with 100,000 tons of coal per day, and that if this was so someone would have to go without next year. Mr. Nute said that many of the gas companies came within one or two days of having to shut down their plants, and that some had to change from the manufacture of coal gas to the manufacture of water gas. Also, that here again we would find only 75 per cent of the oil obtainable in 1918, and that it was up to the gas industry to see to it that they do not go without coal and oil to take care of their demands before the cold weather sets in.

THE TWO-JOB WORKMAN

Mr. Buckminster, commercial manager of the Fall River Gas Light Company, said that people were making good money now, and that the return for their labor was greater than ever before, and that up to the present time there had been a constant increase in the commercial departments.

Mr. Conklin, of the Massachusetts Lighting Companies, told of the way in which gas companies had sold appliances in years passed for cost or below cost, and that they had trained their salesmen to believe that appliances could not be sold for any more than cost. He gave several reasons why appliances could be sold at a profit.

Mr. Kidder, of the Newburyport Gas Light Company, said that the gas companies ought to increase their new business this year according to the increase in business in their respective towns, stating that the wage scale was never so high as at the present time.

He told a story of one of the superintendents of the mills in Newburyport coming into his office and telling him about making his inspection of the night shift at the mill and finding a man asleep. One hour later he passed by and found this man still sleeping. Again the third time he found the man still sleeping. Upon inquiring of the foreman why this man was asleep, he was told that the man was a loom fixer and when a loom broke he was called to fix it, and then returned to sleep again, as he worked during the day in a lumber yard. Mr. Kidder thought this man would be a good prospect for a gas range. The next day he sent a salesman to see him at the lumber yard and sold him a range. This is one of the many incidences where one man holds down two jobs.

Mr. Pettingill, commercial manager of the Woonsocket Gas Company, said that it has been his experience as a member of the exemption board that the average wage was from 20 per cent to 40 per cent more this year than any previous time, and that only about 3 per cent of the city's population was called by the draft, and that about 3 per cent enlisted, making a total of 6 per cent, and that this amount ought not to make any material difference in our sales this year, but that we ought to be able to increase our sales and at a profit.

Mr. Butterfield, of Greenfield, told of experiments he had made with gas burners and his interest in insulated ovens, and that he would have something to tell at a later period regarding these experiments.

Mr. Hunter, of the Baltimore Appliance Company, spoke interestingly of his experiences in profits and losses in the merchandising of gas appliances.

Water Heaters

After the discussion of Mr. Abbott's paper, a discussion on room heaters of the reflector type was opened by Mr. Hayes, of Fitchburg. Many of the manufacturers and commercial managers of the gas companies took part in this discussion.

The following paper on "Water Heaters" was presented by C. Edwin Bartlett at the February meeting:

"To be assigned the subject of water heaters for a brief discussion is quite as gigantic and overwhelming a task as that given in a school history examination: 'Write a brief history of the United States in not over 500 words.'

"Water heaters is a large topic, and in selecting a particular phase of it to take up it is kept in mind that the mechanical construction of the heaters may be learned quite as well, if not better, from the excellent literature published by the manufacturer as by the spoken word; that installation and maintenance are treated copiously in N. C. G. A. publications, and that to bring selling plans to New England would be carrying coal to Newcastle.

First Catch Your Hare

"In these times when every business is disturbed; when institutions, as firm in our beliefs as the Rock of Gibraltar, overturn in a night; when it would cause but a day's wonder if even the famous Rock itself were to fly into fragments; the water heater question revolves itself into a part, but a large part, of the gas industry itself.

"A famous, albeit there is reason to believe a mythical, convention of mice assembled to seek relief from a 'certain dangerous cat,' and a famous recipe for cooking a hare began 'first catch your hare.' Gentlemen, the time is here to bell the cat and catch the hare. What would it profit us to know the intimate details of thermostats and whizzigigs if heaters were not going to be sold, or where would be the virtue in a selling plan that was to go no further than the manager's desk?

Shortage of Gas and Shortage of Cash

"To even the most benighted layman it is no secret that this is the hardest winter in a hundred years, and that gas companies in some cases are facing a shortage of gas and a shortage of cash. The rising costs of manufacture and distribution are also common knowledge. That many difficulties beset the gas man is freely admitted by all.

"It is farthest from the thoughts of the speaker to assume or presume to tell the gas man about the gas business. That may be left to the commissions. But taking advantage of the full and free partnership between the gas man and peddler, which meant so much to the new business end of the industry, let him endeavor to lead the thought to-night toward the 'Will to get water heater business.'

"Back in the days when our fathers were young, an inlet led from Little Egg Harbor through the Jersey beach into the Atlantic. One wintry day a schooner sailed out of the inlet and headed up the coast for Sandy Hook. At dusk the wind veered into the northeast, the snow whirled down and the ocean raged about the craft so that the skipper had nothing to do but to go about and run back for the inlet. The gathering darkness, the snow, and the smother of spume as the boat raced along obscured the lights. Closer and closer to the shore the storm drove the schooner until, in a flash, the skipper sensed rather than saw the inlet light away off to the south'ard, and at the same instant the man at the bow gave 'Breakers ahead.' To anchor was impossible; to beat out to sea again?—she had been running for hours under a rag of a jib! Even to go about would be suicide. But one course remained—the skipper took it. 'Stick to the ship, boys, till we hit the beach, then jump clear if you can!' A black, curling, snarling mountain lifted high the stern. As if on skids the ship sped on the crest. The sound of breakers smashing on sands on either side of the ship warned the praying crew as they clung to the rigging that the moment that wave went out under her bow the keel would strike, the vessel break asunder, and the following crest either cast them on the beach or suck them to the depths. The wave went out under the bow. The ship wallowed and rose under a gentle swell, almost lost way, and with a grunt jammed her nose in the mud of the meadows and lay quietly as at her berth.

"To-day if you look at the map of New Jersey you will see an inlet just below Beach Haven, and about 15 miles above Atlantic City. It is called 'New Inlet' on most maps; on others it is called 'Little Egg Harbor Inlet.' The same powers of destruction that apparently were driving that little craft to its doom on the sands were working at the very sands themselves, and during that stormy night had opened the way to safety. To-day the old inlet is closed. The surf fisherman and the coast guard walk dry shod where once the schooner went out to sea, while where the dry sands taunted her as she raced for shelter flows 20 ft. of water at low tide, the best inlet on the coast between Sandy Hook and the Delaware Capes.

The Moral

"That, gentlemen, is a long story and a true one. The excuse for burdening you with it, your imaginations have no doubt made clear before now. To those companies who have gone down or who have not the courage to stick, there is no use appealing. Those who can't, can't; and those who won't, won't; but to those whose minds are not made up, to those who waver, to those who, for reasons they cannot say what, are getting ready to jump, let us say, 'Stick to the ship.' We are in a storm. Yes, and a bad one; but unlike the story we descry the new inlet. Like the storied one, it is being made by the same forces that are driving our craft.

"When George Ade tells a fable the moral is not always what you expect. While not aspiring to imitate George Ade's masterly moral stories, the speaker wants to point our one moral or point to this story that may escape you otherwise. Those mariners had a ship to stick to. Have we? Only a few of us, but it is a source of comfort that the times are propitious for making one even while the storm rages.

The New Business Department a Profit Producer

"When all is said and done; when the gas shortage sends one new business department on the rocks; when another is scrapped for financial reasons, and when others are cut down for one reason or another, it seems to the speaker that not one would be blasted if we could look the governing power in the eye as a profit-maker instead of an expense. No merchant is closing down; no manufacturer quitting. Why should a profit-making new business department quit? The foundation of any business is profit, and when the new business department is summarized at the end of the year as 'other income,' instead of 'expense promotion,' the new business department will be as sure as the meter reader to be with us.

Discharging Men We Have Beguiled Into Improving Their Value to Us

"Permanency is essential to organization, for without it we cannot obtain that necessary 'esprit de corps' or morale. A salesman who has worked his head off for you for years, studied educational courses, and built up a goodwill for himself and you, is an asset and a human being, and not a machine that can, with impunity, be sent to the scrap heap at will. What must be the thoughts of the many good men who, as though they were contract laborers, have thus far been canned after we have encouraged them to study, to attend conventions, to improve themselves, under the implied assurance that we, on our part, would so manage our business that a little severe weather or financial stress would not find them shelterless? Replace them? Sure! With what? What a tradition to hold out to our new material! What an encouragement to 'be one of us'! This is the second time it has threatened, and in part happened, in four years. We can partly save it now, and absolutely prevent it again by the adoption of the methods your association has endorsed; which A. P. Post will shortly present in the N. C. G. A. *Bulletin* in a paper prepared for the convention which was to have been held last year, and which the speaker had the privilege of setting forth in a paper before the Pennsylvania Gas Association in 1915, and has been advocating ceaselessly for years.

Clinching a Gain

"The opportunity is here now as we sit together in this discussion to clinch for the gas industry a gain that would have taken ten years under normal circumstances. Gentlemen, are we going to let it pass? Can we? Dare we, in justice to ourselves and our interests, quit when a little effort will let us grasp the prize we have been seeking so long?

Setting-Up Exercises and Machine-Gun Tactics

"Does all this seem far afield from water heaters? Perhaps. So do setting-up exercises seem to bear little relation to machine-gun tactics. Water heaters, ranges, lighting and the rest are all, as we have said, subordinate to the prime question that can now be left to discussion.

"Some two years ago the speaker, within these walls, had the honor to address the New England Section of the N. C. G. A. on the same subject. At that time it was pointed out that if the ultimate end which we sought was 'gas the universal fuel,' the way to that end might be said to consist of four steps—lighting, cooking, water heating and house heating. That is true to-day.

"Lighting you have to large extent, cooking you have, water heating is the present step, and house heating you will not get until rates are revised. Water heating, then, is the present consideration. How times and things have changed since that meeting in 1915!

"Then, we know our fight with the coal stove was on economy. Then, we had to talk service, luxury, convenience. To-day—coal at $10 per ton or more, if you can get it at all!

"Then, the country was just getting over a depression. To-day, the country prosperous and the Government about to spend billions among the people.

"Then, the labor market glutted. To-day, every workman employed at high wages, and eager to buy the comforts he has had to deny himself for years. Every home a real prospect.

Selling Arguments Almost Unnecessary

"Then, the rich and well-to-do employing servants to attend their coal appliances. To-day, servants so scarce and arbitrary that a labor-saving device has a real meaning to the wealthy housewife.

"Selling arguments are to-day almost unnecessary. Just imagine what would have been the fate of a prophet who would have predicted three years ago that in 1918 gas water heaters, yea, 'Automatics,' could be operated more cheaply than coal stoves. To-day that is true, and will be true even when the gas rates advance, for coal is up, 'way up, and it will never come down appreciably; at least, it never has.

"And now for the market. If all the homes were already water heater users, then, indeed, were all this labor fruitless. Dry dinners are appropriate settings for statistics. Hear ye a few! Sixty-two companies of all sorts in New England, large and small, high rates and low rates, reported in Brown's for 1917 that they had 393,000 consumers; that of these 393,000 consumers, 225,433 had gas ranges and 63,165 had water heaters. Think of it! Fifty-eight per cent of your people had ranges, and but 16 per cent of all your consumers had water heaters. 'Have you any market?' did you say?

"Dr. E. J. Catell, that delightful old gentleman who serves the city of Philadelphia as its statistician and is loved by every man within its borders, tells a story that seems apropos of our conditions to-day. A certain rich man having entered Heaven, possibly through the 'needle's eye,' was met by St. Peter at the Pearly Gates, and told that he could be granted one wish. He said, 'Give me all the wealth in Heaven.' 'It is yours,' said St. Peter. This transaction was within the hearing of an Hebraic old peddler who was the next candidate for admission, and he had not missed a word of it. 'Now,' said St. Peter, 'what will you have?' 'Just give me a pack of goods and that man's address,' was his quick reply."

C. D. BOND,
Acting Secretary.

The Massachusetts Gas Companies report combined net earnings of subsidiaries for February of $289,089, a decrease of 16.06 per cent over same month of last year.

How the Gas Companies Are Helping the Nation

H. M. Byllesby, president of H. M. Byllesby & Company, who has devoted his time to Government service since November, 1917, as a major in the Aviation Section of the Signal Corps, in charge of national recruiting, has been commissioned lieutenant-colonel in this service.

Charles H. Tenney, of Springfield, Mass., head of numerous gas and electric lighting concerns in Massachusetts and New York State, has been commissioned a lieutenant-colonel in the Ordnance Department and called to Washington for expert service for the Government. He was born in Everett in 1868 and attended the Chelsea High School. He began his business career with N. W. Harris & Company, bankers and brokers, of Boston and New York. Mr. Tenney then engaged in business in New York City as a member of the firm of Thompson, Tenney & Crawford, bankers. He then went to Boston and started the C. H. Tenney Company. Going to Springfield, Mass., several years ago he acquired an interest in the Springfield Gas Light Company, and at the present time is president of the company.

The Public Service Company of Northern Illinois, in the April number of *Public Service Lumen*, announced that vacant land belonging to the company in all divisions, which is available for the purpose, may be used by the employees for gardening this season. There is a considerable amount of such land. In addition to that which is part of the grounds attached to the plants and stations, not used for station requirements, there are odd parcels susceptible of cultivation. All this will be listed by the superintendents. In making allotments, the size of plots assigned will be governed by the acreage and the number of applicants for it. Employees are requested to file their applications with their immediate superiors who will transmit them to the superintendents, by whom decisions will be made before April 10. Employees who cultivated company land last year will be permitted to retain the same plots. It is believed there is sufficient land to supply all who want a garden space.

Industrial Lighting a Field of Wide Opportunity that Presents No Obstacle that Energy and Intelligence Cannot Surmount

(*Continued from page* 332)

The incorporation of the column expressing the consumption of gas lamps in terms of watts is for the purpose of emphasizing the poor utilization of energy in the gas lamp and the consequent need for employing the gas lamp in the most effective manner in order to lessen the weight of this burden. Of course, on the other hand, gas is a cheaper form of energy than electricity, as shown in the following table:

Table II
Cost of Gas Energy

Price per 1,000 Cu. Ft.	Price per Kw.-Hr.*
$0.40	$0.00248
0.50	0.0031
0.60	0.00372
0.70	0.00434
0.80	0.00496
0.90	0.00558
1.00	0.0062
1.25	0.00775
1.50	0.0094
2.00	0.0124

*Based upon gas of 550 B.t.u. per cubic foot.

The low cost of gas energy in many cases far more than counterbalances the low efficiency of the gas lamp, but in industrial practice the differential in favor of gas lighting is seldom so great but that wasteful use of light is likely to more than overcome it. The careless design of gas-lighting systems for industrial lighting is always absolutely inexcusable.

The above table indicates the tremendous economic advantage held by gas as a form of energy if gas appliances are designed to approach electrical appliances in efficiency, convenience and adaptability. Electricity, being an expensive form of energy, must be sold upon the basis of "talking points"—advantages other than energy cost. Their "talking points" are best met, not by putting in the balance against them economy or other compensating advantages, but by so designing gas appliances and their accessories that the advantages now monopolized by electricity will be found to an equal degree in gas, when the "talking points" will dissolve of their own accord and leave the battle to be fought out on the basis of energy costs as shown in Table II. The extent to which this is possible differs in different appliances and uses, but it is at least a goal toward which the principal efforts of the gas industry should be bent.

Utilizing Electrical Data in the Design of Gas Lighting

Returning to the question of utilizing electrical data in the design of gas lighting, it is worth noting that while specifications of "watts per square foot" are no longer of much value on account of the wide differences in efficiency among different sizes of electric lamps of the Type C class, such data are often found in older publications, and it is well to know that they are generally based upon the earlier Type B Mazda lamp, and a corresponding figure per gas may be obtained by dividing the "watts per square foot" by 20 to 25, giving the cubic feet per square foot. For example, if for a certain class of service 1.5 watts per square foot is considered good practice,

$$\frac{1.5}{25} = 0.06 \text{ to } \frac{1.5}{20} = 0.07$$

cubic feet of gas per square foot will, with similar

reflectors, give similar results. Thus, a room 80 ft. by 120 ft. having a floor area of 9,600 sq. ft. would require 9,600 × 0.06 = 576 to 9,600 × 0.07 = 672 cu. ft. of gas per hour to obtain the required illumination.

Reflectors Not an Involved Problem

The question of reflectors is by no means as involved as one might think from a survey of the numerous styles on the market. This will at once be apparent from the fact that porcelain enamel, with which most metal reflectors are finished, the distribution of light practically depends upon the width of the opening and the height of the light source above the opening. For example, in a reflector with a 12-in. opening and a light source 1 in. above the bottom of the reflector, it makes no difference what the shape of the reflector may be, the light distribution will practically not vary. All selling talk referring to "scientifically designed" shapes in porcelain enamel reflectors is pure buncombe. The shape has practically nothing to do with it. The only significant differences among porcelain enamel reflectors are the two dimensions referred to above.

There are for all practical purposes but four important types of reflectors for industrial lighting: the flat cone, the dome or shallow bowl, the deep bowl and the angle, illustrated on page 48 of the handbook of the industrial commission of Wisconsin. The first gives a distribution similar to that of the flat reflectors used with gas arc lamps. The third is substantially the same in distribution to the deep bowl factory reflector furnished for the No. 20 Reflex, except that the latter furnishes about 20 per cent of its light above the horizontal to relieve the dark ceiling spaces which form the greatest shortcoming of metal reflectors in general.

The fourth or angle type is little used with gas lamps except for the smaller units in connection with local machine lighting. The cases in which angle reflectors are desirable for the general illumination of open work spaces are rather few and not particularly important.

Determining Gas-Lamp Reflector to Use

The shallow bowl or dome reflector is very commonly used. Its only advantage over the flat cone is slightly higher efficiency, particularly in small spaces. It has the serious drawback of exposing the light source and is really a very crude, ineffective lighting device. Its only advantage over the bare unshaded lamp is in efficiency of light distribution. Recently it has been modified by fitting a silver-plated cap over the lower part of the lamp bulb, concealing the light source and at the same time reducing the downward light from the filament upward to the main reflector.

In general, any salesman with any eye to proportions ought to be able to determine without difficulty what sort of metal gas lamp reflector will correspond to the reflectors illustrated on page 48 of the handbook.

Glass reflectors, where permissible, are better than metal and a sufficiently wide range of types is available for the No. 2 and No. 20 Reflex lamps. The opal types are preferable and nearly equal in efficiency to the prismatic. Mirror glass reflectors are useful in a very few highly special cases. Usually the metal reflectors are preferable. The only advantage of the mirror glass is efficiency, and against this must be charged fragility, rapid deterioration and high cost.

Indirect lighting, where desirable, is better and more cheaply accomplished by dense semi-indirect bowls than by the totally indirect types, except where glass bowls are out of the question. Indirect lighting is far from the panacea for lighting ills which many seem to think it.

Generally speaking, the practice recommended in the handbook is one that may be easily followed by anyone with a reasonably strong inclination to inform himself on the subject of industrial lighting, and lighting systems planned in conformity with the rules will agree with what is commonly accepted as good modern practice. Even the best practice, however, falls far short of what is being done in other classes of lighting, and industrial lighting must still be regarded as in a very crude and undeveloped condition. The best that can be said for the best recent practice is that it is infinitely better than what preceded it.

The many problems which arise out of peculiar and unusual circumstances call for a rather extensive knowledge of illuminating engineering practice and a great deal of common sense and trained capacity for observation which can only come from wide reading and broad experience. Unless gas companies are prepared to encourage men to become really proficient in the practice of illumination, they had best leave the field alone, for their efforts will prove unsuccessful.

The aggressive work of the factory-lighting field will develop a demand for a wider range in sizes and styles of gas lamps. This, however, the lamp manufacturers can meet without difficulty when the need arises. Industrial lighting is a field of wide opportunity, hedged about by not one single obstacle that brains and energy cannot surmount.

Each Condition in Furnace Operation Must be Served by a Brick Made to best Serve the Purpose the Furnace is Intended to be Used For

(*Continued from page* 316)

Silica brick consists of crushed quartzite mixed with a suitable binder of slaked lime, moulded into desired shapes, dried and then fired to convert the mixture into a mineral complex which possesses desirable properties for furnace construction. The desirable properties are:

(1) Ability to withstand sudden changes of temperature without cracking or disintegration.

(2) Refractoriness at the highest temperature employed in the furnace.

(3) Resistance to the attack of products of combustion.

(4) A regular and not excessive coefficient of expansion.

The silica is the skeleton and the lime is the binder. Upon firing a lime silicate is formed which is more fusible than silica, and which binds the particles together. The more lime that is used, the more easily will the brick fuse at a lower temperature. Since the formation of lime silicate is aided by intimate contact of lime and

silica, hence the smaller the particles the larger will be the surface exposed per unit volume and the greater the amount of lime silicate formed. One method of obtaining a minimum of voids and surface of silica is to mix two sizes of silica, one about one-half the size of the other. Such a procedure also reduces the lime bond necessary.

Fenner, of the Geophysical Laboratory at Washington, has investigated the transformations occurring in silica at elevated temperatures, and found that:

(1) The change from alpha to beta quartz occurs at 575 deg. C. and is rapid and reversible.

(2) The change from beta quartz to tridymite occurs at 870 deg. C., and is very sluggish and also reversible.

(3) The change from tridymite to cristobalite occurs at 1,470 deg. C., and is very sluggish and also reversible.

The specific gravity of quartz is about 2.66, that of tridymite and cristobalite 2.27 and 2.33, respectively. Thus the tridymite and cristobalite are lighter than quartz, from which they originate. This explains why a silica brick expands upon being fired. In firing silica brick the change that occurs is from quartz to cristobalite mainly, but this change takes place very slowly. When all the quartz has been changed to cristobalite the change in volume is complete and no further expansion takes place.

Seaver has shown that brick made from Barbaroo quartzite and burned for forty hours at 1,540 deg. C. had about 77 per cent of the quartz changed to cristobalite. A second and third reburning at the same temperature for forty hours extended the change from quartz to cristobalite to about 83 per cent and 84 per cent, respectively. The expansion in the brick intended for by-product coke over silica is 3/8 to 7/16 in. per foot, which is the change from pure quartz to wholly cristobalite.

Firing Limitations

Ross cut 2-in. tubes from silica brick made from the principal quartzites in this country, and fired them at 1,400 deg. C., 1,450 deg. C. and 1,500 deg. C. He found that the porosites decreased, the volume expansions increased, and the specific gravities decreased with treatments at the temperatures noted above. The Pennsylvania and Wisconsin quartzites that had reached equilibrium upon firing at 1,500 deg. C. showed very small changes as compared to the same materials fired at 1,450 deg. C.

Thus it is clear that unless silica brick are fired above 1,470 deg. C. to complete the change from quartz to cristobalite, there will always be a residual expansion in the brick when subsequently heated in furnace operations. Such expansion will result in the formation of cracks in the walls of the furnace or retort that may be very serious.

From the results of the tests on the volume changes in silica brick, Ross believes that a fairly accurate and rapid determination of the completeness of the volume change and the firing temperature can be made by taking the specific gravity of the brick.

The methods proposed by Ross for volume, porosity and specific gravity changes are as follows:

$$\text{Volume} = \text{Wet weight} - \text{suspended weight.}$$

$$\text{Porosity} = \frac{\text{Wet weight} - \text{dry weight}}{\text{Wet weight} - \text{suspended weight}}$$

$$\text{Specific gravity} = \frac{\text{Dry weight}}{(\text{Wet wt.} - \text{susp. wt.}) - (\text{wet wt.} - \text{dry wt.})}$$

"The range of porosities observed are between 22.64 per cent and 31.96 per cent, and indicate what is likely to be found in industrial practice." The specific gravities of all bricks tested by him lay within the limits of 2.66 and 2.27, which are also the limits between raw quartz and tridymites. Since the specific gravities of tridymite and cristobalite are 2.27 and 2.33, respectively, there is ample range to designate those bricks which have been fired at a high enough temperature, and to fix the quality of the material. The tests proposed by Ross are simple and may be made rather rapidly.

Gas Demonstrates Marked Superiority in Tempering Saws

Among the largest saw manufacturers in the country are Disston at Tacony, a suburb of Philadelphia; Simmons Company, of Fitchburg, Mass.; Atkins, of Indianapolis, Ind.; Bishop Saw Company of New Jersey; Thompson Saw Company of New Jersey, and the Fulton Saw Company, of Cicero, Ill.

At the beginning of saw making secrecy surrounded every process performed, and while the industry is the very reverse of unprogressive, it yet retains a strong flavor of conservatism, declares E. J. Caspers in the April issue of *Public Service Lumen*. To illustrate this it may be said that one of the concerns mentioned on the foregoing list has been in business for sixty years, and has men on its payroll who have been there since the start. A good many have served fifty years. This particular company does not discharge men for inefficiency. If the individual does not fit in one job he is moved to another.

Crucible steel is used for the high-grade saws and open-hearth steel for cross-cut and hand saws. Although, of course, saws of various sizes for diverse purposes require some modification of the several stages, in general the journey of a saw from its beginning as an ingot to the finishing point is much the same. After leaving the oven it is submerged in oil at a high temperature, and then is cleaned with sawdust. By way of the buffing machines the saw goes to the grinding room, where emery wheels automatically grind the teeth, a dozen or more wheels working at the same time. In the straightener, which is held at a temperature of about 900 deg. Fahr., the saw is pounded with a cross-face hammer. Cross-cut and hand saws go through the same operation which secures flexibility. Limberers and straighteners to fit the saw are used.

The tempering of the saw is really the vital operation. Wood and coke have served as fuel and also oil, and of late years electricity has had a part. The use of gas for the purpose is comparatively recent. The engineers of the Public Service Company of Northern Illinois designed for the Fulton Saw Company, of Cicero, a hardening furnace to be run on that fuel, which in practice has proved completely successful. The hearth is 10 ft. x 6 ft. x 3 ft., with interlocking tile. The flame is directed under the hearth, thus eliminating the moving of the saws. No trouble is experienced in holding the oven at the desired temperature, which is nearly 1,700 deg. Fahr. Preliminary work necessary with other fuels is saved. This furnace will take a saw 60 in. in diameter.

The Fulton company formerly used crude oil as fuel. Gas has eliminated all the trouble that is experienced with oil.